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PART I.
Original Contributions.

CLINICAL GROUPS OF CASES OF AMAUROSIS.

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(Continued from Vol. IX, Part II, p. 130.)

GROUP IV.—NEURITIS AFTER OTORRHŒA, &c.

Case 52. Neuritis following Injuries to the Head—Neuritis from Disease at Base, spreading from Middle or Internal Ear—Neuritis from Cerebral Hæmorrhage.*

F. 415. Job B., 42.

Amaurosis and neuritis, with severe headache; imperfect symmetry, rapid onset, subsequent improvement. Headache chiefly on R. side for a year before failure. R. eye worse than L.

History of abscess and discharge from L. ear and temporary paralysis of L. facial nerve (leaving permanent traces) 2 years before V. failed.

Intraocular changes very slight.

Improvement of R. from no p. l. to 19 J. Improvement of L. from 19 J. to 1 J. and $\frac{2}{10}$.

No proof of syphilis.

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Case 53. F. 342. Edith S., 5.

Failure of V., with neuro-retinitis (deep-seated haze of discs and white deposits in retinae), followed by atrophy.

Preceded by severe cerebral symptoms, violent sickness and headache, and partial R. hemiplegia, affecting the lower limb and the R. face and muscles of R. eye.

Perfect recovery except as to V.

The illness probably symptomatic of disease spreading from L. ear. There had been otorrhœa following measles for many months before the illness began.

Urine, no albumen or sugar.

Case 57. O. H. R., V. 105, B. 189 and 276. Walter S., 28.

Amaurosis and atrophy with diminished arteries and jagged choroidal rim after double optic neuritis. Death 14 months after symptoms began. No syphilis. Blow on head some years before.

Chronic meningitis at base of brain, matting nerves together; general softening of brain.

1864, January. Failure of V. Severe pain over eyes for a week or two.

May. Slight attack of L. hemiplegia and incoherent speech.

June.

July.

August.

September.

October.

November.

December.

1865.—January.

} Very severe headache, often causing a semi-comatose state.

} Improved in health. Loss of smell and taste.

February. Frequent fits.

February 20. Died.

Case 58. G. 283. Frederick E., 23.

Slight neuro-retinitis of R., with moderate defect of V., accompanying paralysis of L. 3rd and 4th nerves; all these symptoms coming on about 3 months after a blow on L. eye by a fist.

L. eye defective for long, and shows rather doubtful evidences of past neuritis.

Probably had syphilis 5 years ago.

I ? Node involving L. 3rd and 4th nerves and optic tract.

II ? Double neuritis from "coarse disease," causing pressure on L. 3rd and 4th nerves, but not involving optic tract.

GROUP V.—AMAUROSIS AFTER INJURIES TO THE HEAD, OR TO 5TH NERVE.

Case 56. Fracture of Base of Skull—Hæmorrhage, Concussion, Convulsions, and Partial Paraplegia—Loss of Speech (Language) and Sight.

B. 100. (Dumbness, p. 16, Astley Cooper Prize Essay.) Harriet L., 25.

Amaurosis (bare p. l.) of both, and complete dumbness after a prolonged convulsive seizure, which followed about 10 days after a severe injury to head (fall from window).

The injury caused several hours' unconsciousness, and there was vomiting of blood.

There was paresis of lower extremities (? of arms also), and she was unable to stand for 3 months, but no affection of sphincters.

Pupils too small. Eyes kept shut. No paralysis of any ocular muscles, but spasm of *occip. frontalis* when she tries to open the eyes. No ophthalmoscopic note. Hearing and intelligence good. There was suspicion of malingering, and she was put under chloroform, but she never spoke, although efforts were made to induce her to do so.

Case 59. B. 315. Ann W., 8½.

Amaurosis (partial), with partial simple atrophy of discs. No evidences of ocular neuritis. V. large print at 3 inches.

Following about a month after a fall on the head, which caused sickness and temporary loss of consciousness, but no other immediate symptoms.

Failure of sight not accompanied by any other symptoms.

Case 60. B. 213. William C., 30.

Amaurosis and atrophy of disc coming on many years after injury to the eye. The injury causing rupture of choroid.

1852. L. eye struck by a key. "Quite blind for 6 months."

Gradually regained enough sight in the injured eye to be able to read.

1863-4. Gradual failure of L. again to total blindness. Atrophy of disc and great diminution of arteries. Old ruptures of choroid. Slight displacement of lens. Posterior synechiæ.

Case 61. B. 212. ? Published. Ambrose H., 49.

Gradual failure 4—5 months, L. much the worse.

Wound of L. frontal nerve 5 years ago.

3 years ago, was, for a joke, hung by his comrades until insensible, and was so ill afterwards that his surgeon advised that his deposition should be taken.

No ophth. details.

Case 62. Immediate, total, and permanent Blindness as the result of a fall on the Head, which occasioned only slight concussion injury to one shoulder.

B. 156. William C., 40. Railway guard.

No perception of light. Milk-white atrophy of discs and great diminution of retinal arteries; has been blind about a year. A year and three-quarters later he was in just the same state.

It was a railway accident, and he was within an ace of being crushed by a slowly-moving train.

All his other organs and functions were perfect throughout.

Case 63. Amaurosis following injury to 5th Nerve.

O. H. R., IV, 125 (B. 17). Benjamin B., 52.

Gradual failure of one eye with deafness of same ear, and paresis of corresponding 5th and facial nerves, after severe lacerating blow on jaw and forehead of same side.

Ophth. doubtful, slight pallor of the amaurotic disc. V. 20 J. barely 3 months after accident.

? Absorption of orbital fat.

Case 64. F. 25. Joseph B., 56.

Atrophy of disc going on to all but complete blindness, coming on gradually during many months, and beginning about 9 months after a fall on back of head. Some slight affection of speech and breathing, as if from paresis of soft palate.

Other eye lost many years by injury.

Asserted (probably pretended) loss of smell and taste from the date of the injury.

Case 65. F. 19. Jno. W.

Æt. 5. Fell in the street, and struck R. forehead. Became insensible in an hour or two, and remained so 14 days.

Bled a little from ear and nose.

Expected to die.

Blindness found out 1 month after accident.

Paralysis of L. side was present 3 months after accident.

9 months after accident, R. eye said by Mr. Critchett to be worse than L.

Æt. 14. V. 20 J., barely. Atrophy of discs, more in R.

Æt. 19. V. the same; practically blind.

Case 66. ? Optic Atrophy from injury to one 5th Nerve.

G. 264. John D., 47.

Failure of L. to absolute blindness in 2 months, with pain, $8\frac{1}{2}$ years after contused wounds of L. temporo-malar region.

Excision.

Failure of R. eye without pain shortly after L. had become blind; going on to bare p. l. in about 4 months.

A year after failure began, advanced atrophy of disc and some diminution of arteries. No strong evidence of neuritis.

Cornea slightly hazy.

Case 67. O. H. R., VII, 45. C. 105. Jeremiah S., 66.

Atrophy of L. O.D., and nearly complete blindness (V. shadows), vessels much diminished; and complete deafness of L. ear; after severe blow on head by a falling tree which laid him up for 10 days. Date of failure of V. in relation to accident not stated, but probably immediate, or soon after. The deafness was immediate.

History of partial L. hemiplegia for a long time after the accident.

Seen 12 years after the accident on account of corneal ulcer of the other eye.

Case 68. C. 6. Wm. D., 45.

Pitched out of a cart on to top of head. Bled severely from nose and probably from ears.

Insensible "for a fortnight."

Recovery 1 month after accident with—

i. Irregularity from fracture of floor of R. orbit and R. squamous temporal bone.

ii. Absolute loss of smell.

iii. No p. l. in L. eye.

iv. Defect of R. eye.

12—14 months later—

L. no p. l.; advanced atrophy.

R. imperfect, but he thinks a little better than a year ago.

O.D. pale, but not so white as L.; whiter on *y. s.* side.

Complete loss of smell.

Taste and hearing good.

Case 69. L. H. R., I. 55 (and B. 122), Case 34. Geo. S., 55.

Amaurosis with atrophy slowly progressing to total blindness; L. failing before R. and becoming blind earlier.

Discs grey-white; arteries somewhat diminished, but not greatly so.

Failure began soon after a fall on back of head, causing concussion and unconsciousness for a few minutes.

Health good.

Condition of eyes and health the same 4 years and 6 years after he became blind.

He was about 3 years in going blind.

A great smoker.

Case 70. Andrew B., 42.

18 months ago. Injury to R. side of head, a graze by very heavy mass of iron. Not thought serious.

1 week later began to see double and his R. ear swelled. Diplopia very soon went off and R. eye found to be nearly blind. V. went in about 8 days.

Now. R. bare p. l.; O.D. pale, vessels n., or but slightly diminished. L. $\frac{2}{3}$ o. Slight haze on *y. s.* of O.D. only; colour n.

Other symptoms since the accident;—

Hyperæsthesia of R. side of head; constipation for last 12 months; stiffness and "soreness" of hips and legs if he sits still. Slowness of ideas. Failure of sexual appetite.

History of swelling of R. leg and thigh after the injury to head. No syphilis.

This case was possibly one of loco-motor ataxy in early stage, and the injury only a coincidence.

Case 71. Bag and B. 22. Elizth. K., 9.

Complete blindness of R. eye without any visible change in O.N., retina or choroid; p. active.

Blindness followed immediately or soon after a violent blow on the eye with a stick, which caused much bleeding, 6 months before admission. No evidence of malingering.

Case 72. L. H. R., i, 53, Case 27 (and B. 60). Isaac Waters, 49.

Progressive amaurosis, not quite symmetrical, but ending in all but total blindness of one eye, and absolute of the other, beginning shortly after a severe blow on back of head, causing insensibility for a few minutes. No other symptoms.

Case 73. B. 26. William W., 35.

Failure of V. within a week or two of a severe blow on head by 12 lb. weight, falling 11 feet. Insensible 20 minutes.

Much pain in head.

Atrophy of R. o. d. 13 weeks after accident.

L. o. d. good colour. This eye was defective before accident; old choroido-retinitis.

Case 74. ? Intraocular Neuritis of R. as the result of a blow, ascending and affecting L. at Commissure.

G. 391. Wm. F., 47.

Atrophy of both, with evidence of former neuritis in R., but not in L.; almost complete blindness.

Failure moderately gradual. R. failed several months before L., and was first noticed immediately after a severe blow on the eye by a piece of wood.

Probably paralysis of accommodation.

Probably had syphilis 21 years ago.

Sleepiness, but no other constitutional symptoms.

GROUP VI.—NEURITIS FROM THE PRESSURE OF INTRA-ORBITAL TUMOURS.

The three following cases are chiefly important as proving the occurrence of neuritis in one eye from pressure

upon the trunk of the optic nerve within the orbit. In many cases of proptosis, it would appear that the nerve may bear considerable pressure and stretching without any evidence of swelling of the disc.

Case 75. (C., p. 255). C. W., 33, married man. Neuritis with only moderate effusion in one eye only, probably due to pressure on optic nerve by node in orbit. Proptosis and swelling of lids. V. improved greatly with iodide of potassium.

Syphilis 7 years before.

He had a fit subsequently.

Case 76. (O. H. R., VII, p. 611). Thomas T.

Optic neuritis with proptosis from intra-orbital melanotic tumour.

Case 77. G. 323. Thomas L., 59.

Neuritis in one eye from pressure of pulsating tumour in orbit.

GROUP VII.—CASES OF OPTIC NEURITIS IN WHICH THE CAUSE WAS NOT ASCERTAINED. ALSO SOME CASES OF NEURO-RETINITIS FROM RENAL DISEASE, OR ASSOCIATED WITH GOUT, &c.

Optic Neuritis from Uncertain Cause.

Case 78. C. 278. John H., 37.

Neuritis (woolly discs) with absolute blindness, preceded by photopsiæ. Loss of V., progressing to blindness in 3 months. Ps. medium, equal, quite fixed. Very little headache until after the loss of V. Since then liable to attacks of most intense jumping headache, sometimes causing loss of consciousness. Attacks lasting a few hours and then ceasing entirely. Coming on at intervals of from 2 or 3 days to several weeks. Occasional pins and needles in face, and attacks of trembling and loss of use of L. limbs.

Case 79. F. 16. Jas. W., 37.

Gradual failure of V., with great pain in forehead.

“Neuritis in both” noted about a year after failure began, but

notes incomplete; there is some account of a temporary failure a year ago, followed by recovery and a more recent relapse.

Five years after the notes were taken, he was in good health but quite blind.

Case 80. F. 108, and O. H. R., viii, 495, Pt. iii. Wm. P., 58.

Double neuritis, ending in partial atrophy, but with great improvement of sight. History of a previous temporary failure, and of several attacks of hemiplegia. Doubtful syphilis 40 years ago.

Case 81. B. 65. Mary C., 42. (August, 1862.)

Left hemiplegia, with pain in shoulder and hip, and then in scalp; next, symmetrical neuritis, with total loss of sight. History of variations of sight. Gray discs and small arteries. *No p.l.* Intense frontal headache.

Admitted in August, 1862. She had perfect sight until the previous Christmas (1861). She first noticed that her eyes were failing, and "she was getting dark." She then had "the cruellest pain in her forehead, as if there was something between the skin and the bone." She had had ten children, five of whom were living. She always had good health before her present illness, and was never subject to headache. About two years ago, one hot summer day, she walked seventeen miles, and then drank some cold water. She slept very badly the following night, and, a fortnight later, "pins and needles came in her left arm." She had afterwards great pain in the left shoulder and left hip, and then "the pain went to the crown of her head." Her husband and she differed as to whether it was two or four years since she became paralysed, but both agreed that it followed the occurrence referred to, and came on gradually. She had only been two months blind; and it was a remarkable point that sometimes her sight had greatly improved, and then again wholly failed. Although now quite unable to perceive light, she still asserted that even yesterday "for a few moments she could see into the yard, but she could not keep it."

The pupils were of large size, and quite motionless; the aspect was amaurotic. She was quite paralysed in her left arm and leg, which hung useless. She could feel in the hand, but only very imperfectly. With great difficulty I got a glimpse of the optic disc in the right eye. It was not white, but of a mottled grey specked with black, very ill defined. The arteries were small; the

veins of moderate size; the choroid normal; the pupils were widely dilated.

There can be little doubt that in this case all the symptoms—the loss of sensation, loss of motion, neuralgic attacks, and final symmetrical failure of sight—were due to some central cause.

Case 82. B. 128. John B., 44.

Amaurosis from neuritis followed by atrophy, more advanced in R. than L., in connection with pain in head, giddiness, deafness in R. ear, and paresis of R. 5th N. Deafness and giddiness 3 years. Paresis of 5th N. 1 year. No syphilis.

Note of condition being the same some months later.

Case 83. B. 207. Hy. O., 45.

Double optic neuritis, swollen, fluffy discs, with great defect of V. (20 J.), of probably 5—6 months' duration; gradual improvement up to 6 or 8 J., with absorption of lymph, but retinal vessels remaining much diminished, and discs grey. Failure of V. preceded by diplopia and headache, chiefly frontal; and some paralytic symptoms in left hand and foot. Subsequent L. hemiplegia (imperfect).

Death 4 years after failure of V. Granular kidneys, but no disease detected in brain.

The improvement of V. and loss of the paralytic symptoms in hand and foot occurred while taking iodide and mercury.

Case 84. G. 25. Chas. W., 40.

Gradual failure of both, but R. several months before L. Nearly complete blindness in about 18 months.

Admitted 9 months after V. had become stationary (2½ years after failure began). V. then = bare p.l.

R. then advanced atrophy; central artery of good size.

L. still partially obscured by lymph, which must have been present about 2 years.

Ps. motionless and partly dilated.

Four years later wrote that he was quite blind.

Subject to rheumatism (relapsing form) in various joints.

Syphilis possible about 15 years ago, but not proved.

Case 85. F. 85. Mrs. Y., 33.

Failure of L. 1 year.

„ R. 2—3 months.

Neuritis passing into atrophy in each; more advanced in L. Remains of lymph in both. Arteries considerably diminished. A month after admission V. worse: = shadows. Ps. somewhat dilated.

Failure of each eye preceded and accompanied by pain in back and in head, and sickness. Recovery of good health for several months between the failure of the two eyes.

After second eye failed, some pain, numbness, and weakness of limbs; speech hesitating; loss of memory. L. arm worse than R. Subsequently fits. Final state not known.

Perhaps syphilis $3\frac{1}{2}$ years ago ($2\frac{1}{2}$ years before symptoms began).

Case 86. B. 385. Geo. L., 25. (Probably published O. H. R., vol. v, p. 168.)

Typical neuritis in each eye, with woolly, grey, elevated discs. Gradual failure of sight 9 months, but without any symptoms of disturbed health, except latterly nervousness attributed to over-smoking; none of the usual symptoms which accompany neuritis. V. 12 Sn. barely.

Latterly excessive nocturnal emissions. General health good.

Disagreement of mercury (made him feel weak but did no good); ophthalmoscopic appearances and symptoms quite stationary for 8 months.

Case 87. C. 354 and 338. John R., 28.

Double neuro-retinitis with much lymph on discs, and many extravasations and some white deposits in retina. Ps. equal. V. very defective.

No albuminuria (tested several times). Some defect of R. external rectus.

No history of syphilis.

Great improvement of V. under iodide of potassium.

Case 88. B. 216. Bernard T., 40. (July, 1864.)

A case of typical neuritis with swollen woolly disc, and numerous hæmorrhages into the retina near the disc, in one eye (L.); and in the other (R.) atrophy of the *y.s.* side of the disc with considerable diminution of all the retinal arteries, probably following neuritis.

Extreme defect of sight (barely fingers) in the atrophic eye; good vision (8 J.) with the neuro-retinitis eye.

Failure of the atrophic eye stated to have come on suddenly 2 weeks before I saw him. He was at the time ill in the London Hosp. with pain in the head, and had had this symptom for 2 months. He attributed his headache to getting wet and catching cold.

No note of progress.

Case 89. C. 288. Henry F., 14.

Recovery of nearly perfect sight, with pale discs but central vessels not diminished, after acute double neuritis (swollen woolly discs) with total blindness for 1 week.

Ps. large and almost fixed.

Failure preceded and accompanied by headache, loss of appetite and sickness. He recovered under mercurial treatment.

Illness occurred at end of May, in hot weather (1868).

Heard of in 1875 (æt. 21), and then V. remained so good that he had enlisted in army.

Case 90. C. 86. Bridget W., 21.

Double optic neuritis and amaurosis. Failure of V. coming on suddenly in association with weakness of R. arm and leg, and preceded by giddiness and headache.

The weakness of arm and leg remained for (probably) several months.

(Symptoms (loss of V.) began at Christmas. She was admitted Dec. 31, but probably 12 months (not 1 week) after the failure. No later note. Dates incomplete.)

Case 91. G. 47. Wm. B., 58.

Double optic neuritis, more advanced in R., and with hæmorrhage in that eye. Liable to gout for many years. No albuminuria.

Four years later he wrote that he was quite blind and in feeble health.

Case 92. G. 31. Chas. W., 32.

Failure of both alike in about 6 months to absolute blindness. Ps. moderately dilated but fairly active. V. bare. pl. Subsequently no p.l.

On admission, 6 months from beginning of failure; well marked woolly neuritis of R.; beginning to clear off on *y. s.* side. L. less lymph, more atrophy. Arteries much diminished in both.

Slight pains in head during the failure, but no other symptoms. Nervous manner; speaks very deliberately, and occasionally sighs.

Mother died insane at 50, had been so for some years.

Father living, æt. 103.

No syphilis. Married and 4 children.

Case 93. B. 224. Mrs. M.

Paralysis of R. third and fourth nerves, and atrophy of R. disc; former temporary paresis of R. arm.

No syphilis known, but severe pain in head.

Case 94. G. 43. Frances C., 13.

Atrophy of discs more advanced in R., and with considerable diminution of vessels in that eye. No choroiditis.

Failure of V. said to be of only 4—5 months' duration.

Patient the subject of strongly-marked hereditary syphilis.

Elder brother has abundant choroiditis.

Case 95. G. 227. James D., 40.

Atrophy of discs and diminution of arteries, probably after neuritis, and with V. much worse in one than the other.

Horizontal hemiopia in one eye.

Failure began 4 years ago, and soon became stationary in R., but went gradually to shadows in L.

Ill for several months previously, with great thirst, bad appetite, weakness, and increasing corpulence. Diabetes suspected, but not confirmed (Dr. Pavy).

The symptoms began 10 months after his second marriage.

Syphilis possible, but not evidenced. No lead poisoning. No other nerve symptoms.

Case 96. C. 63. Geo. D., 19.

20 months ago, pain in R. face and head, followed by an abscess at outer corner of R. eye. Rapid failure of R. eye a few days after abscess burst. Now sees shadows. O.D. grey-white; veins beaded. Arteries diminished; some haze on O.D. (Old neuritis.)

Deep hollow beneath extr. angular process. Eyeball somewhat prominent.

5 months ago, pain in L. temple for 3 weeks; then rapid failure of L. to blindness in 5 days. Now no p. l. O.D. just as in R. There is now an abscess in L. temporal region, and enlarged cervical glands.

A very peculiar case.

Case 97. Neuritis probable. ? Syphilis. ? Sunstroke.

F. 43. Robert Haywood, 34.

Rather sudden failure, progressing for 3 months, a year ago, without any other symptoms.

Atrophy of discs, with evidence of former neuritis, but vessels not much altered.

Ps. rather large and R. oval. V. fingers.

Soldier; has been to West Coast of Africa for several years, but had no fever.

No note as to syphilis.

Six months later, no better.

Case 98. M. C. T., Case 19, B. 230. Wm. R., 45.

Amaurosis with atrophy, slowly progressing to all but absolute blindness in 2—3 years. R. eye preceding L. by 6 months. Failure of R., preceded by violent earache, with giddiness and great sleepiness.

Ps. equal, too small, and quite motionless, but dilated well to atrop. O.Ds. dirty gray; vessels not materially altered.

Health and strength good.

Case 99. G. 234 and O. H. R., viii, iii, 499. Mrs. J., 35.

Neuro-retinitis with hæmorrhages in one eye of a woman who had disease of liver and piles.

Case 100. G. 238. Mrs. S., 30.

Failure of L. suddenly the morning after she had got very wet; was menstruating at the time, but it was not checked.

Neuro-retinitis with hæmorrhages near O.D., and haze about *y.s.*

V. 16 J. about 5 days after the failure.

V. same 3 years later, and other eye not affected.

Case 101. Choroido-Neuritis, with Hæmorrhage in Typhus Fever.

B. 188. John B., 50. (1864.)

Complete atrophy of one disc, with extreme diminution of all retinal vessels; numerous large recent blood extravasations in choroid, and small ones on disc. Sight extremely defective, and soon going on to no perception of light.

These changes confined to one eye, and coming on during the delirium of a fever (? typhus); was delirious 2 weeks, and in the Fever Hospital 7 weeks.

The other eye had been cataractous for 13 years; he had good perception of light with it, and after removal of the (fluid) lens, he was able to read large print with suitable glass.

Case 102. C. 289. Wm. C., 53.

Gray atrophy of discs and diminished retinal vessels, with some small hæmorrhages at periphery, and much damaged V., after albuminuric retinitis.

Myopia, and in R. a large staphyloma.

Case 103. F. 37. O. H. R., VII, 480. Mrs. N., 37.

Retinal hæmorrhages, and disease of vitreous, with, later on, doubtful detachment of retina, in L.

Atrophy of disc, probably the result of similar retinitis, in R. She suffers from gout (inherited).

Case 104. Results of Albuminuric Retinitis?

F. 295. Fredk. B., 39.

Atrophy of discs, and some choroido-retinal changes, probably secondary to hæmorrhages, with much diminished retinal vessels. All but total blindness.

History of gradual failure, without other symptoms, while at sea in India, æt. 37; formerly much subject to nose-bleeding.

History of several attacks of ? cerebral symptoms at intervals during the preceding 4 years; in one of them severe nocturnal headaches.

Probably had syphilis at about æt. 29.

Case 105. B. 336. James S., 56, painter.

"Neuritis and apoplectic effusions" probably in R. eye only, and of only a few days' duration.

Had had violent toothache on R. side, with pain in R. forehead, for a fortnight before, and had "a week of dreadful pain in the eye and side of face" after his first attendance.

The failure of sight was attributed to "a sort of sun-stroke" which occurred just before the sight failed, while he was painting close to the copper roof of a verandah at temp. of 92° F.

Case 106. L.H.R. I, 50, and B. 47. Case 21. Jas. S., 31.

Gradual failure of L., and rather sudden failure of R., a year or two before admission. Variations in sight.

July, 1862. V. barely 16 J. with + lens.

Ps. equal and normal size, but sluggish. O.Ds. too red?

August. O.Ds. somewhat pale, especially L.; yet V. best with L.

June, 1864. V. as before, no worse; liable to temporary attacks of increased dimness. Ps. large and sluggish. Small but definite patch of diseased choroid at each *y.s.* O.Ds. gray-white. Central artery in each small.

It was at first thought to be a tobacco case.

He denied all V.D., and there was no history of any symptoms. Was very drowsy, but formerly had not been so.

Case 107. F. 201. Mrs. A., 37.

Severe neuralgic headaches, 6—7 weeks. Failure of V. 4 weeks.

Slight neuritis with some white lymph on discs, and a doubtful hæmorrhage.

Discs pale, especially L. Defect very slight; V. = $\frac{2}{20}$ and 2 J.

No syphilis.

Subject to chronic rheumatism in joints.

Case 108. F. 265. Mrs. S., 45.

Neuritis, ending in partial atrophy, with very little defect of V. in a woman for years subject to nervous headaches and latterly hemicrania.

History of partial paraplegia some years ago.

Subjective tastes and smells.

Syphilis unproved, but not improbable.

GROUP VIII.—PROGRESSIVE AMAUROSIS, WITH ATROPHY OF DISCS.

A. *Atrophy of Discs and Amaurosis as a part of the Changes occurring in various forms of Insanity.*

In some the amaurosis preceded, while in others it followed the appearance of other symptoms.

Some of the patients became permanently insane, and died in that condition. One (Case 113) recovered after temporary insanity, but with atrophied discs; in this case and in another (Case 27) perhaps nearly allied to it, the failure was gradual, and in neither was there any proof of syphilis; in neither was there much evidence that intraocular neuritis ever occurred; in both it may be surmised that some structural changes took place during a limited time, and probably syphilis, although not admitted, was the most likely cause.

Case 109. M. C. T. Case 53. B. 196. John R. P., 51. (1864). Has been a clerk in City house 20 years.

Gradual amaurosis, with gray-white atrophy, without much alteration of vessels. Pallor greatest on *y. s.* sides. No other disease of fundus.

1861, æt. 48. Took a business for self. Increased anxiety.

1863, April, æt. 50. Several times slight giddiness. Loss of flesh, pallor, great weakness. V. began to fail. No other nerve symptoms.

1864, May. First seen.

1865, December. V. worse. Cannot see large objects, and yet has photophobia. Ps. motionless and slightly too large. Health good.

1867, May. Became patient at Bethnal House Asylum.

1869, March. Died there. Never regained his sight.

Case 110. B. 191. James G., 56.

Amaurosis coming on gradually during some months to almost total blindness. Partial atrophy of discs, like tobacco blindness, but with some diminution of arteries, after an attack of insanity, &c. A very intelligent man.

1864, æt. 46. Gradual imperfect paraplegia, permanent; worse in L. leg.

Æt. 51. After business troubles, insomnia for weeks, followed by mania. 3 years in Hanwell Asylum. Severe pain in head at beginning of illness.

Æt. 56. Failure of sight. Drowsiness. Partial anæsthesia of fingers.

A year or two later was in Colney Hatch, and had been there 16 months. Paraplegic, violent, almost blind.

No note as to syphilis.

Case 111. L. H. R., I. 40, Case 4. (A. 2, 94, and B. 56). Charles N., 45.

Absolute blindness and atrophy of discs in a man who had been threatened with general paralysis and with insanity.

Case 112. G. 258. George B., 40.

Rather rapid onset of failure the day after going to Brighton on August Bank holiday.

9 months later, slight atrophy of discs. V., R. 19 J., L. 14 J.

2 years after failure, somewhat more advanced atrophy. V., shadows.

Failure preceded by nervousness and weakness, but no definite illness. Failure of memory. Later on great diminution of sexual power. Much indigestion for years. No other signs of nervous disease.

A very moderate smoker, and continued it more or less for about 9 months after failure began.

Probably not a tobacco case.

? General paralysis coming on.

Case 113. G. 106, and L. H. B. 11. Philip B., short, stout, very muscular.

Æt. 31½. V. began to fail very slowly. Had for some months before had giddiness and headache. Smoking ½ oz. a day.

Æt. 33. V. shadows. Blue-white atrophy of O.Ds. and some diminution of arteries. Ps. moderately dilated and sluggish; acted well to atropine. Sycosis of face.

Left off smoking for several months, but then resumed.

Æt. 33½. Went to Margate. Bathing depressed him extremely, and took away appetite. Symptoms of insanity began.

Æt. 35—36. Insane for 17 weeks. Violent a part of the time.

Æt. 43. Has remained well except occasional shoots of pain in the head. Ps. medium, insensible to light. O.Ds. same as before, vessels considerably diminished. No evidence of past neuritis.

No history of syphilis, but risk admitted. A brother had epilepsy.

Case 114. G. 394. John W., 44.

Atrophy of discs and amaurosis. Failure of V. 18 months.

The pallor of discs uniform, not like a tobacco case.

Formerly a great smoker, but for 6 months past only 1 oz. a week, and milder tobacco.

Very intemperate (claret); tremulous; cannot eat.

Died 2 months after notes were taken. "Epilepsy and Congestion of the brain of 10 days' duration."

Case 116. O. H. R., V. 227, B. 246. Elizabeth C., 16.

Failure of V. at æt. 10 or 11, gradually going to only p. l. at time of admission.

Idiocy and liability to fits from infancy. Atrophy of discs without diminution of vessels.

History of fits and other nervous disorders in maternal relatives, but not in mother herself.

Case 117. B. 237. Charles C., 24.

Atrophy of discs and partial amaurosis, after fits, headache and despondency. "Brain-fever" 2 years before the failure of V.

Subsequently more fits and cerebral symptoms.

Father died insane.

Case 118. F. 405. Elizabeth B., 25.

Atrophy of discs. V. never good, but has got worse lately.

History of fits at about æt. 12 and since.

V. now very defective.

Mother insane, and reported to have very bad sight, and to have been formerly very intemperate.

B. *With Disease of Spinal Cord.*

1. Cases illustrating the amaurosis occurring in locomotor ataxy.

2. A group of cases of progressive amaurosis, ending in atrophy of discs, with symptoms of disease of the spinal cord, but not locomotor ataxy. The amaurosis is sometimes quite symmetrical from the outset; in other cases one eye precedes the other. The pupils are motionless to light; often too small, and never materially dilated. They are often of unequal size.

Failure of sexual power is noted as a marked symptom in almost all.

Some of these cases are, at first, difficult to distinguish from the amaurosis caused by tobacco.

Case 119. Wm. B., 38.

Atrophy of discs much more advanced in R.

V. R. bare p.l.

V. L. nearly perfect.

Locomotor ataxy beginning in R. leg 7 years ago; then L. leg and back, and then numbness of fingers. Then 4 years of ptosis of R. and diplopia, followed by failure of V. about 4 months ago.

Impotence following a period of great sexual excitement at the beginning of his complaint.

Ps. motionless; L. the larger.

Case 120. C. 308, O. H. R., VI, 283. Joseph P., 57.

Amaurosis (nearly complete) and atrophy of discs; coming on in about 6 months.

Several years later, signs of locomotor ataxy; and xanthelasma palpebrarum.

Several years before failure of V., almost universal alopecia came on; it was permanent.

Had never smoked.

Case 121. G. 130. Thos. W., 45.

Locomotive engine driver.

Locomotor ataxy of about 5 years' duration.

Now partial atrophy of discs (*y.s.* side); L. much more than R., but without impairment of V. ($\frac{2}{3}$ and 1 J. with each eye).

Dilatation of R. pupil and weakness of accommodation for 5 years, but attributed to a severe blow on the eye.

Case 122. B. 235. M. C. T., Case 17. Thos. K., 50.

Probably locomotor ataxy.

Failure of V. about 10 months.

Atrophy of discs.

Numbness and weakness of lower limbs, and subsequent imperfect co-ordination.

Loss of smell.

Failure attributed to attack of delirium tremens.

Case 123. Bag and Day Book, 24th Jany., 1875. Wm. H.

Spare, healthy-looking coachman.

Rapid failure of V. with atrophy of discs, imperfectly symmetrical. Ps. absolutely motionless; slightly larger than natural, and L. rather larger than R.

Failure of sexual function, without previous excess; aching in back; stabbing pains in legs, and some weakness or feeling of weakness, and yet no inability to walk long distances. No inco-ordination; slight incontinence of urine.

Case 124. Bag. Wm. H., 50.

Failure of V. gradually in several months, symmetrically, down to 18 J.; began rather suddenly.

Numbness in fingers lately; occipital headache and tightness across bridge of nose, and definite failure of sexual power for a year past.

Was always liable to cold feet. Married at æt. 22, and always had good health.

The amaurosis, accompanied by clouds of black muscæ, "like rooks;" never formerly subject to muscæ.

Ophth.: notes incomplete, but probably discs more or less atrophied.

Case 125. C. 195. Jas. R., 41.

Progressive failure of V. more rapid in L. than R.; atrophy of O.Ds., also more advanced in L.; paresis of L. 3rd nerve, and subsequently weakness of legs.

Probably disease of cord, or motor tract in brain. No evidence of syphilis.

Case 126. G. 274. Geo. W., 50.

Gradual failure of V. 8 in about 12 months to no p.l. with R., and fingers with L.

Advanced atrophy of discs; *lam. cribrosa* exposed in R., but still obscured by slight opaque whiteness of disc substance in L. (slight neuritis).

Shortly before failure of V. began, he lost all sexual power, and lately has had some retention of urine. No unusual constipation.

Appears in good health, but a great spirit-drinker and large smoker (rum and shag).

While under care, he diminished his rum a good deal, but was still drinking $\frac{1}{2}$ pint a day.

Case 127. F. 226. Mr. B. (railway goods' manager). "Already published."

Absolute amaurosis, with gray-white atrophy of discs, without much diminution of vessels,

Myosis, and partial resistance to atropine.

Subsequent partial paralysis of limbs.

(Note in February, 1871).

(Also under Dr. Jackson's care in 1871).

Case 128. C. 343. K.

Atrophy of discs, more advanced in L., without evidence of neuritis.

Numbness of feet and cold sensation in back.

Ps. motionless, not much dilated, but L. larger than R.

Several years after first note, "still smokes freely."

Notes extending over several years (1864 and 1868), but there are probably earlier ones; possibly already published as tobacco.

Case 129. C. 275. Mrs. M. C., 39.

Complete blindness (no p. l.) with blue-white atrophy of discs and much diminished vessels; slight haze of discs, but no positive evidence of neuritis.

Æt. 27. Overworked and anxious. Failure of memory, and sudden attack of cerebral symptoms, followed by partial dementia with paresis of R. side; and 6 weeks later nearly complete loss of V. Recovery of good health and partial recovery of V., lasting 12 years, but history of variations of V.

Æt. 39 (6 months before admission). V. again failed to complete blindness. Much severe aching and shooting pain in head.

Married since the first illness, and has had one child.

Case 130. ? Spinal Disease.

B. 239. George C., 49.

Rapid failure of sight, with atrophy of discs and diminution of retinal arteries and veins, more advanced in left. L. p. dilated and fixed. Slight divergence of eyes with diplopia in early stage.

Progressing to absolute blindness in about 6 *months*, and then attended by numbness and pins-and-needles in hands and feet, sometimes accompanied by a fleeting rash of red, hard, painful patches on calves of legs and fronts of arms.

About $1\frac{1}{2}$ year after sight failed, "a weight and numbness about the abdomen."

History of several severe blows on head within 20 years. One 6 mos. before eyes failed; another slight blow by a glancing nail on L. cheek near eye, 1 week before failure.

No somnolence. A smoker.

Under care December, 1864 to May, 1866.

C. *Amaurosis in Young Men without assignable cause; Hereditary Atrophy; Progressive Atrophy in Women.*

This is a small group, the cases being very infrequent. It is, however, of great interest, and the more detailed study of similar cases may throw light on the causation of other forms of progressive atrophy and of disease of the nervous system.

The failure in most of these cases in young men is rapid. When seen tolerably early, there is sometimes marked evidence of neuritis. With regard to other symptoms, we find many variations. In some the patients have had headaches and cold feet; some have been exposed to great sun heat; some are smokers and drinkers; others have never smoked. In one there was a family history of insanity. The state of the pupils varies a good deal. In some there is evidence of central scotoma. I am not acquainted with any cases in young women resembling these.

Perhaps if the family histories had been more complete, some of the cases would have been found to belong to the

well known and very peculiar group in which progressive atrophy of the discs occurs in several members of the same family, some of them being young men and some being women. I believe that no other symptoms of disease of the nervous system accompany this form of amaurosis, and that it seldom progresses to complete blindness. In progress, result, and in the absence of other conspicuous symptoms, these cases closely resemble those of tobacco amaurosis.

Closely allied to the cases in these two groups is a third very small group, in which women are the subjects of slowly progressive amaurosis, with atrophy of discs, without other discoverable disease.

Case 131. B. 133. L. H. R. I., 58, Case 42. John B., 18.

Amaurosis, with only slight pallor (yellow) of discs, coming on quickly while in prison in July. Seen 2 months later at Moorfields, and could then just see 20 J. with R., and not so much with L.

Had had neither tobacco nor alcohol during his 15 months' stay in prison, but had good diet and was in fair health.

Slight feverishness for a few days before failure.

Case 132. G. 263 and O. H. R., VIII, Case 43. Henry F., 21.

Failure suddenly while exposed to tropical sun at sea; a heavy smoker and drinker.

Atrophy of discs, uniform, with diminution of arteries, and slight patch of opacity on one disc; said to have had neuritis by an earlier observer.

V. better at night than by day (probably due to central scotoma).

Some improvement of V. while still smoking. There had been no other symptoms of nerve disease.

Tobacco very doubtful as the cause.

Case 133. John W., 23.

Gradual failure during about 3 months down to 20 J. with L., and shadows with R. Discs atrophied and opaque, with remains of lymph on them. Ps. ordinary size; R. very sluggish, L. active.

Failure beginning while at work in harvest-field in August,

but no history of sunstroke. He did not work bareheaded in the sun.

During failure his feet were very cold at night (a new thing to him), and afterwards he had some severe headache extending from forehead to occiput.

A small smoker. No syphilis. No masturbation. No lead poisoning. Health appears good.

Case 134. C. 200. Wm. W., 20.

Failed 3 months ago, rapidly; he believes in a single night it failed to its present degree = $\frac{20}{100}$ and 16 J. at 4'', but evidence of this rather imperfect.

Discs pale and slightly hazy, and the arteries considerably diminished, and some evidence of choroidal changes near O. D.

Ps. large and sluggish.

A smoker. The failure occurred in March. He attributed it to worry from having a cart and horse stolen. No note as to syphilis.

Case 135. C. 181. Wm. S., 18.

Failure of V. in a fortnight down to $\frac{20}{100}$ and 10 J. at 5'', preceded by headache, but no sickness.

At a fortnight after it began O.Ds. considerably congested, and very slightly hazy; retinal veins very much engorged, without being very tortuous.

Ps. rather dilated and very sluggish; dilated more when covered.

Hy. $\frac{1}{24}$ after atrop., but no improvement.

Under care $2\frac{1}{2}$ months, and remained the same, the defect being most marked at centre of field.

Subsequently wrote to say that his V. gradually improved, and 7 years after the failure there was "not much the matter."

A very unusual case.

Tobacco not noted. ? Masturbation.

Case 136. Rapid Failure to Total Blindness in a few weeks. Extreme Atrophy of Discs and great diminution of Vessels.

B. 200. M. C. T. Case 22. W. McC., 21.

1863 (spring), æt. 19—20. In good health; smoking and drinking freely. Unmarried.

April. Leaves off smoking entirely.

May. Becomes a total abstainer.

October (early part). V. begins to fail.

„ 25th. Marries.

„ 28th. Has to leave off work because V. has become so bad.

November. Treated at Hull by counter-irritation and mercury to salivation.

1864, June, æt. 21. Has been blind for 6 months (no p.l.)

Other nerves perfect.

Health good.

While V. was failing, had photopsiæ and once had two curious attacks of spasm of lower extremities.

Case 137. G. 95. Alfred Haynes C., 27.

Gradual failure of both eyes together at æt. 21; down to shadows, in about 6 months.

Atrophy of discs, probably (from appearances) after neuritis, without much diminution of vessels. V. best by dull light.

A slight smoker throughout.

Liable to considerable headaches.

History of insanity and other nervous diseases, in several predecessors, on father's side, male and female.

History of gout and occupation of painter in several of father's side. Patient, a painter, but no symptoms of lead-poisoning.

No evidence of syphilis, but risk often.

Case 138. C. 65. M. C. T. Case 5. Benjamin P., 15.

[R. defective for long; not sure when it failed, or whether it was ever good.]

Gradual failure of both 5 years ago, without other symptoms.

L. = puzzles out 20 J.

R. = quite blind.

Discs white, especially on *y.s.* sides; vessels not materially diminished.

They failed in 6 months to their present condition.

Ps. small and dilate very little with atropine.

Never smoked till after V. began to fail.

Probably defective virility.

Case 139. C. 122. Jas. A., 16.

Myopia from childhood. Gradual failure of V. since he went to sea, about 2 years ago. Has been in hot climates.

O.Ds. pale and slightly hazy, and arteries very much diminished. Veins less diminished in proportion than arteries.

Ps. large.

Appearances "exceedingly suspicious of past neuritis."

Not a smoker. No syphilis.

No illness of any kind.

Hereditary Amaurosis.

Case 140. M. C. T., Case 24, and B. 184, and C. 314. Jas. G., and Mrs. G., his mother.

Slowly progressive amaurosis, with white atrophy in a woman at the climacteric period, going on to nearly complete blindness. History of very severe headaches and morning sickness.

A son the subject of similar conditions, and a nephew said to have the same symptoms, both being smokers.

D. Unexplained Progressive Atrophy in Adults of both Sexes.

(Some probably due to Syphilitic growths pressing on Optic Tracts or Centres.)

Case 141. F. 21. Mrs. F., 37.

Progressive failure to total blindness in about 6 months, with atrophy of nerves, and no certain evidence of neuritis.

R. failing before L.

Deafness.

Severe pain in head, especially forehead, for several months before the failure began.

Syphilis 6 years ago.

Case 142. F. 128. Mrs. H., 40.

Failure of V. in about 6 months down to p. l. Partial atrophy of discs, more on *y. s.* sides.

For a year or more before failure began, liable to attacks of pain in head, and to fits of unconsciousness without convulsion. 2 weeks before failure unusually severe headache, with vomiting, and accompanied by deafness of L. ear. Headache sudden and intense.

Always liable to bad sick-headaches.

Very probably syphilis by conception, but not proved.

Case 143. B. 82 and L. H. R., i, 56, Case 36. Mrs C., 46, a widow.

Failure of V. rather quickly, about 1 year before admission, the L. being the worse. At and since this time she was intolerably sleepy. For a long time before failure began was very sleepless, having originally been a fair sleeper. No headache, a little giddiness. Occasionally had double V. at long distances.

Good health, liable to flush much.

V. 20 J. barely, better with R. Discs moderately white, L. the more so; arteries somewhat diminished.

Ps. large, equal, very sluggish.

Case 144. Mrs. W., 49, actress.

A very peculiar form of neuritis and consecutive atrophy; discs greenish-white and waxy, the *y.s.* sides absolutely devoid of vessels, the remainder hazy as if from green-tinted wax.

Central vessels not materially altered.

Ps. small.

L. failing 6 years; R., 3 years; V. = bare p.l.

Has had good health and no head symptoms, but is feeble.

No lead poisoning.

Case 145. G. 89. Maria S. P., 52.

Gradual failure of V., 5 years; much more quickly, 12 months. Slight neuro-retinitis (haze).

V. not noted.

5 years ago sudden partial R. hemiplegia, recovering in a year; 1 year ago, history of a fit (? epileptic, but said to have been a "sunstroke").

Failure of memory.

No reason to suspect syphilis, acquired or inherited.

History of excessive "nervousness" in childhood, "so nervous, it was thought she would not live."

Case 146. F. 358. Mrs. B., 55.

Failure of V. 2 years, gradual. Headache and sickness often.

When admitted, atrophy of discs with remains of neuritis in one. V. R. shadows; L. 20 J. barely. Arteries diminished.

3½ years later she wrote that R. had improved, but L. had become entirely blind; the R. having formerly been the worse.

She took iodide for some months.

No proof of syphilis.

No note as to urine.

Case 147. F. 396. Anne S., single, 46.

Neuritis passing into atrophy of both, with almost total blindness.

Gradual symmetrical failure of V. for 12 months.

Always subject to sick headaches with vomiting, and they have been rather worse lately.

Suffers from chronic joint rheumatism.

History of an illness ("low fever"), attributed to anxiety, æt. 30.

No reason to suspect syphilis.

Case 148. C. 294. Mrs. H., 56.

Atrophy of discs and extremely defective V., worse in L. Gradual failure about 1 year, with pain in L. side of nose and at inner canthus.

Ps. fixed, R. rather larger than L. T.n.

Long continued arsenical poisoning from artificial flowers.

Case 149. O. H. R., V. 315. C. 10. Anne R., 40.

Advanced atrophy of O.Ds., more in L. than R. Vessels of fair size. With R. can see largest print.

Both failed in childhood after fits, and a fall downstairs on the head.

All her life subject to headaches, with sickness, and to much dyspepsia.

Seen again æt. 46, and had then commencing xanthelasma on each upper lid.

In the L. there were patches of atrophied choroid.

Is said to have had water on brain.

No note as to hereditary syphilis.

Case 150. C. 41. Mrs. R., 60.

Intense pain in eyes and head, especially top and back, with failure of V. in both, and impaired movements of the eyes.

In 3 months (June, 1866), V. = just counts fingers. Ps. active and n. size. No increase of T. Retinal veins turgid and discs congested.

No other changes.

February, 1868. V. improved, and with + 10 she reads small print; improvement gradual. Still much pain in head, but not much in eyes. Health much improved. O.Ds. n.

Took very small doses of iodide for a year and a half.

No note as to syphilis.

Case 151. B. 144. Eliza H., 29.

Amaurosis coming on rapidly, and going on to complete extinction of sight in one night in L., and in 5 days in R., with severe headache, proptosis, ptosis, and limited movement of eyes.

All the symptoms occurring at menstrual date, the flow being absent, and having previously been regular.

Great sleepiness.

Gradually increasing headaches for several weeks before.

Ps. moderately large; very sluggish.

Retinal arteries rather small, and retinae? slightly hazy.

Case 152. Amaurosis in a Woman resembling Tobacco Amaurosis.

M. C. Trans., 1867, Case 2. Mary Anne H., 52.

Gradual failure of both eyes during 2 years, down to bare p. l. The R. was, she says, at first the worse.

Blue-white discs; arteries somewhat diminished.

No cause assigned. Not a smoker. Health good.

Case 153. Symmetrical slow Amaurosis in a Woman.

O. H. R., v, 168 (and B. 168). Mrs. S., 51.

Failure of both gradually during 4—5 months down to V. = shadows with L. and = 20 J. badly with R.; and $\frac{20}{60}$.

Yellowish pallor of discs, general in L., more on y. s. side in R. Slight doubtful diminution of arteries.

Failure attributed to distress at death of child a year ago (about 6 months before failure of V. began).

Death after sudden pain in head, followed immediately by 12 hours' unconsciousness, 4 months after coming under care, and 8—9 months after failure of V. began. No p. m.

Case 154. B. 206. Rebecca W., 66.

Gradual failure of both, but L. most rapidly, 5 years ago; rapid increase of failure, 4 years; since then L. quite blind; R. varying, occasionally better, especially after sleep, but usually nearly blind.

O.Ds. very white; arteries and veins diminished.

Pupils rather small, nearly motionless, dilate imperfectly to repeated applications of atropine.

Much anxiety and sleeplessness before V. failed, but no other cerebral symptoms.

Case 155. M. C. T. B. 248. Case 1. Eliza N., 29.

Slowly progressive failure of V. to all but complete blindness in about 10 months, with bad headaches, muscæ, and photopsiæ.

Discs pale at first, and becoming very white, with much diminished vessels after a few months.

Case 156. C. 360. Sarah J.

Atrophy of discs, going on to complete blindness at about æt. 27.

L. failed before R.

No evidence of neuritis; discs clear gray-white, and vessels not diminished, when seen 4 years and again 9 years after failure.

Ps. retained activity, but acted irregularly.

Failure accompanied for a time by violent headache, but no sickness.

Photopsiæ and white mists still complained of years after she had lost all p. l.

Failure began at about time she was under care for uterine displacement. Has never menstruated.

Case 157. L. H. R., i, 54 (and B. 94). Case 33. Wm. H., 54. Intemperate and a smoker.

Gradual failure of both for a year. On admission R. rather the better (20 J.), but its pupil considerably larger than L. Both ps. very sluggish.

Atrophy of discs, with great diminution of all the central vessels.

Case 158. O. H. R., ix, 125, and B. 55. John C.

Symmetrical amaurosis with white atrophy. Gradual failure during 3—4 years, beginning 8 years after severe blow on face. The blow followed very soon by permanent paralysis of R. external rectus.

Condition 13 years after admission, and 17 years after failure began, "totally blind."

Case 159. B. 13. Richard H., 42. 1861 or 1862. Probably published.

Failure of sight 3 months.

Dimness the only symptom.

Cannot now see hands on clock face. Formerly perfect sight.

12 years ago depressed fracture of L. parietal bone; nervous ever since.

2 years ago lost his property, and took to drinking.

9 months ago became very heavy for sleep, but this has passed off.

Now restless and nervous.

Discs yellow-white; vessels not diminished.

Ps. ordinary size.

Case 160. F. 303. Jas. H., 45, gardener.

Gradual failure, with delayed symmetry, going on to all but blindness in both, in about 6—8 months.

Discs atrophied, more advanced in the R., which failed first.

Vessels considerably diminished in the worse eye.

Ps. inactive.

A slight smoker; left it off entirely, but continued to get worse.

No other symptoms whatever, except later on some deafness of R. ear, with aching pain.

Drinks very moderately.

Doubtful syphilis many years ago.

? Spinal disease.

Case 161. F. 51. Henry T., 45.

Gradual failure of both, with photopsiæ, 18 months or 2 years.

Some frontal headache during the last 3 weeks.

Advanced atrophy of discs, dirty greyish. Slight changes, as if from past neuritis, at circumference of discs.

Has not smoked for 20 years.

Case 162. G. 122. Wm. C., 43, from Dr. Eady.

Gradual failure 9 weeks. Partial atrophy of discs, with haze of retina for considerable distance around.

Gradual continuance of failure to almost blindness in about 7—8 months from commencement.

Retinal arteries somewhat diminished.

Syphilis possible some years ago, but not proved.

A very small smoker.

No evidence of lead poisoning.

Case 163. G. 123. Jessie B., 47.

Rapid failure in 3—4 days down to 20 J. with R., and 14 J. with L.

Pallor of discs, and slight haze of retinæ for some distance around; vessels considerably diminished in R., not diminished in L.

Probably had syphilis several years ago, but no evidence of it now present.

His evidence as to rate of failure not very trustworthy.

Case 164. Bag. H., 26, a farm labourer (1863).

Amaurosis with white atrophy, more advanced in L. Failure 10 months.

No cerebral or spinal symptoms.

A very small smoker.

Case 165. Book "Amaurosis," p. 56. John G., 50.

Blindness from white atrophy of discs, with great diminution of retinal arteries, but not of veins.

Failure began 10 years ago; was complete in a year.

Was very sleepy; had headache, and still has it.

Never smoked.

Case 166. Book "Amaurosis," p. 20. Samuel D., 62. No date. Probably 1862.

Slowly progressive failure of sight, without any accompanying symptoms.

Previous giddiness and pain in head on looking upwards, for about 3 years.

Indigestion many years.

Health good.

No mention of tobacco.

No ophth. exam.

Case 167. Book "Amaurosis," p. 17. James S., 45. April, 1862.

Atrophy of discs and great diminution of retinal *arteries* (not of veins), with all but complete blindness (bare percept. light) coming on in 2 years.

Failure began soon after prolonged anxiety and hard work (wife's illness and death).

Tobacco not mentioned.

Case 168. C. 82. M. C. T., Case 4. Wm. Y., 47.

Gradual failure of both to complete blindness in 9 weeks, with severe pain in temples coming on after failure began.

Remained quite blind for more than 2 years, and on admission ($2\frac{1}{2}$ years after failure began) he could see shadows.

A smoker, but left it off 6 months after failure began because it made him nervous. (Note, however, that he was then blind, and probably, therefore, not living so well as usual).

No evidence of constitutional syphilis.

Gray atrophy of discs with considerable diminution of arteries. L. paler than R. No other disease. Ps. rather large and almost motionless.

*Case 169. Probably neuritis and paralysis of R. external rectus.
? After sunstroke.*

C. 178. William P., 52, a sailor.

Atrophy of discs and considerable diminution of arteries.

L. no p. l.

R. sees large objects.

Ps. normal size and almost motionless.

Convergent strabismus of R. (State of R. external rect. not noted).

V. failed 10 years ago in the tropics, but failure has been gradual. At first he had diplopia, when R. began to turn in; is sure he did not squint before.

Good health.

Could never learn to smoke; tried when very young and gave it up.

Case 170. F. 218. Thos. B., 34.

Amaurosis with slight doubtful neuro-retinitis more marked in R.

V. $\frac{20}{200}$ and 20 J.

Preceded by very severe headache entirely preventing sleep.

History, and present evidence, of old compound fracture of skull from a fall at æt. 5 years on to a broken bottle.

Not a smoker.

No note as to syphilis.

Case 171. Progressive Atrophy in Tertiary Syphilis.

G. 19, and M. F., 261. Daniel S.

Under care Metrop. Free Hosp. in 1857 (*æt.* about 38) for rash on arm, probably syphilitic.

Æt. 45, began to suffer from severe headaches (vertex), coming on every few days and keeping him awake at night.

Æt. 46 (about). V. began to fail, and has slowly got worse.

Æt. 52. V. shadows. Advanced atrophy of discs; vessels not materially diminished.

No history of nodes or of any tertiary syphilitic symptoms except the headache.

Case 172. M. C. T. Case 33. C. 119. Thos. W., 38.

Gradual failure of V. with considerable pain in forehead.

R. O.D., atrophied on *y.s.* side. Vessels of fair size.

L. O.D. pale, and its borders hazy; vessels (both arteries and veins) very much diminished on the disc, and several of them concealed close to its edge.

V. very defective in both.

No later note.

Case 173. G. 96. Geo. P., 30.

Failure of V. 6 mos.

Began in R. 1 mo. sooner than in L.

Very white atrophy of discs, with oscillation. Not much evidence of neuritis.

No history of syphilis.

Has lived abroad in the colonies.

Case 174. G. 146, and O. H. R. viii, 1, 51. Capt. W., 59.

Atrophy of discs and gradual failure of V., with deafness of one ear. Threatened R. hemiplegia.

Bleeding from throat from slight causes.

Evidence of collateral retinal circulation on one optic disc, in which the *vena centralis* is nearly invisible.

Case 175. Failure of Sight 6 months, accompanied by an increase in the severity of Sick-headaches to which Patient had been liable for the previous 5 years.

F. p. 215. Charles P. A pale, spare man.

Failure coming on at æt. 50, and progressing to almost complete blindness in $1\frac{1}{2}$ year.

Discs atrophied, and showing very slight and rather doubtful signs of neuritis. The changes more advanced and apparently older in the right than in the left eye.

Patient a smoker until about the time his sight began to fail, but then leaving it off for no special reason. Failure of sight progressing nevertheless to all but absolute blindness.

No lead poisoning to be detected.

(See also III c.)

D. Cases which were possibly due to Tobacco.

II e. Most of the following are probably cases of *Tobacco amaurosis*. The majority of them, however, present some complication or peculiarity, in regard either to other possible causes, or the course of the disease, or in respect to the ophthalmoscopic appearances. I have omitted from this report all cases in which the diagnosis of tobacco amaurosis was certain, having reported on them fully elsewhere.

In the first case a tropical sun may have had some influence.

Case 176. F. 242. David B., 48, sea captain.

Amaurosis and atrophy of discs. V. 14 J. barely, and $\frac{20}{100}$. Failure in 1 month, while in tropical seas, at æt. 45—46. V. remained stationary after that, till admission $2\frac{1}{2}$ years later. Was suffering from dysentery rather badly when it failed.

Syphilis severely, æt. 28.

Smokes largely, but no disagreement.

No note as to sunstroke.

Case 177. G. 60. John E., 42.

Tropical night-blindness in a sailor, but with partial atrophy of discs.

A great smoker. ? Tobacco amaurosis, influenced by bright light.

Case 178. G. 39. William C., 35.

Slight amblyopia, with pallor of *y. s.* sides of O.Ds.

V. best in dusk.

Improvement and subsequent slight relapse, both times after extra work.

Supposed to be a tobacco case, but he went on smoking throughout.

Perhaps mere accommodative asthenopia.

No hypermetropia.

? Slight astigmatism.

? Disseminated sclerosis.

Case 179. A Stationary Tobacco Case?

C. 136. George F., 47.

Gradual failure of both, but becoming stationary after a time, and V. remaining, $7\frac{1}{2}$ years after commencement, the same as at 15 months after. R. = $\frac{2}{6}$ and 16 J. L. rather less.

Atrophy of *y. s.* side of O.Ds., arteries stated to be "very small" at first visit.

A smoker. Diminished it 12 months after failure began, because it disagreed, but continued to smoke somewhat, and apparently had again increased when seen 6 years after admission.

Case 180. Probably Arrested Tobacco Amaurosis.

G. 239. Charles R., 50.

Atrophy of discs and some diminution of arteries and veins; symmetrical failure in about a year to 20 J. and $\frac{2}{6}$.

A year and half later could see 16 J.

A considerable smoker, and very nervous.

Failure arrested, though he continued to smoke; he diminished his quantity, however, by half.

The pallor of discs affected their whole area.

Case 181. F. 64. Crane B., 46.

Improvement of V. in (probably) tobacco amaurosis, without cessation or diminution of tobacco.

Gradual failure of both while at work in South America, near sources of Amazon, and during time of great anxiety and bad sleep. Failure in about 1 year till he could not see across room. Stationary 6 months; improving 3 months.

V. $\frac{2}{7}$ and 14 J.

Slight pallor of O.Ds., more on *y. s.* sides. Slight retinal haze near O.Ds.

Ps. active and small.

For 25 years has smoked about $\frac{1}{2}$ oz. daily. No note that he had diminished it.

Excellent health. No syphilis. Had no illness in South America.

Case 182. Probably an Early Tobacco Case.

F. 315. Henry R., 43.

Slight failure of V. with slight pallor of discs, especially on *y. s.* side, and doubtful retinal haze. Failure gradual during several months. All the conditions rather worse in R.

V. 1 J. barely, and $\frac{2}{40}$ each eye, but better with L.

A considerable smoker and drinker.

Slight attacks of ciliary and conjunctival congestion occasionally.

V. got no worse, and was just the same $3\frac{1}{2}$ years after admission, the pallor of discs being confirmed by observation at that date.

He left off or diminished smoking for a considerable time.

Case 183. M. C. Trans. Case 25 (and B. 175). Henry G., 31.

Symmetrical amaurosis, gradually coming on during 3 months, without other symptoms excepting sleepiness.

Gray-white discs, left the whiter, and arteries somewhat diminished.

"The whiteness very marked" 1 month later.

Published as a tobacco case.

Always intolerant of tobacco, and always easily sea-sick, though a pilot.

GROUP IX. ATROPHY OF DISCS, WITH PARALYSIS OF ORBITAL NERVES.

*"Ophthalmoplegia externa" Series.**

The cases in this series probably represent various pathological states due to different causes.

* For further facts respecting this group see paper by the author in the forthcoming volume of Medico-Chirurgical Society's Transactions.

In one of the most typical (Case 187), although the man denied syphilis, it is probable that he had had it, for his eldest living child was markedly syphilitic.

Another (Case 190) had had syphilis, but his symptoms progressed in spite of treatment.

Perhaps these cases belong to the same group as those in which atrophy of discs precedes general paralysis and insanity.

Case 185. G. 324. Maria P., 40.

Atrophy of discs and amaurosis after neuritis. Pupils widely dilated. Severe headache, with more or less sickness and constipation at intervals for 2 or 3 years during and after the sight failed.

Later on paralysis of some branches of both 3rd nerves.

No note as to syphilis.

Case 186. Paralysis of several Orbital Nerves.

L. H. Repts., vol. i, p. 48. (Case 15.) James N.

Case 187. Long Book. Robert S., 48.

Slowly progressive paralysis of 6th nerves, the R. preceding the L. considerably.

Followed by similarly progressive atrophy of discs and blindness.

Liability to attacks of severe pain in forehead, lasting some days.

Subsequent paralysis of all limbs, coming on rather quickly; liability to intense pain in the head; insanity; death at æt. about 53.

Post-mortem examination revealed no changes in the brain visible to the naked eye.

Probably had syphilis many years ago.

Case 188. J. 122. Abraham B., 72.

A fit, followed by L. hemiplegia and R. facial paralysis at æt. 68.

Nearly complete recovery.

Subsequently paralysis of 3rd, 4th, and 6th nerves on both sides, and of ciliary muscles.

No syphilis.

Case 189. J. 9. John H., 34.

Slowly progressive weakness of legs, with obstinate constipation, retention of urine, and impotence. 6 months.

Symmetrical failure of sight, 4 months. Atrophy of discs.

Subsequent progressive paralysis of both 3rd nerves and one 6th. Numbness of soles and shooting pains in legs.

Former venereal excesses and over smoking and drinking.

Intolerance of tobacco and alcohol when the other symptoms began.

No evidence of syphilis.

Case 190. C. 364. F. W. M.

Slowly progressive paralysis of several orbital muscles, followed by atrophy of discs and blindness. Beginning with the L. 3rd nerve at æt. 36, and remaining more advanced on that side.

Good health throughout. Temporary numbness of L. arm; "tightness" across forehead; susceptibility to heat.

Syphilis many years ago; but prolonged antisymphilitic treatment of no avail against present symptoms.

He is now æt. 45.

GROUP X. ATROPHY OF DISCS IN SENILE PERSONS.

Probably this series is allied to the cases in which there is also central disease of choroid. (Tay's amaurosis.) (See vol. viii, p. 231, of these Reports).

*Senile Amaurosis.**Case 191. B. 75. George S., 77.*

Failure gradual for 2 years, of both eyes.

Discs pale, and vessels small. Some striæ in lenses, but not enough to account for the defect.

Case 192. B. 72. William R., 76.

Symmetrical amaurosis coming on during about one week, and beginning after an unusual day's work at cabinet-making. Slight giddiness for a day or two, but no other symptoms. When first seen, could not count fingers. Ps. small, equal and fairly active.

Six weeks later V. was the same.

No ophthalmoscopic note.

Case 193. Amaurosis. ? Tobacco. ? Senile degeneration.

F. 316 and O.H.R., vii, 322. Thomas E., 62.

Commencing atrophy of discs (*y. s.* side), and gradual failure of V. in both for 18 months.

V. R. 19 J.

L. 16 J.

Ps. fairly active to light, but not fully so to atropine.

Partial deafness, and signs of cerebral degeneration.

Subject to true gout.

Has worked in lead.

A rather large smoker.

Died æt. 64; no notes of progress of V.

Case 194. G. 383. Geo. L., 67.

Failure of V. to 16 J. barely, and $\frac{20}{200}$ (with his glasses), in about 3—4 months.

Atrophy of disc, with decided but slight haze of retina in R.

No changes, or the slightest pallor in L.

Spontaneous venous pulse in both.

Opacities in vitreous of both, but these probably old, for he has had "a web" before his sight for 25 years or so.

Failure of memory.

V. remaining about the same for more than a year after admission.

No disease at *y. s.*

No proof of syphilis.

Is subject to gout.

Case 195. G. 29. Joseph B., 69.

Failure of V. gradually for 6 months down to 16 J. and $\frac{20}{200}$; defect first noticed at night.

Pallor of discs with disturbance of choroid at margins, as if from past neuritis. Vessels about normal.

Floating bodies in vitreous.

History that the eyes were very red and watery, though not painful, for 6 months before V. began to fail. It passed off about the time that V. began to fail.

No syphilis.

Has not smoked for 5 years; it used to disagree, and he left it off.

Often frontal headache; worse on R. side.
Good health.

Case 196. C. 21. Richard P., 74.

Failure of V. for three months.

Gray discs; arteries somewhat diminished, with atrophy of large patch of surrounding choroid, and in L. some choroidal disease at *y. s.*

Central opacity of each lens.

9 months later "just the same conditions;" and V. = only the largest letters.

GROUP XI. ATROPHY OF DISC AND AMAUROSIS, AFFECTING ONLY ONE EYE OR BOTH EYES WITH DELAYED SYMMETRY.

Although this group has been separated into four divisions, many points of resemblance will be noticed between the cases placed in each.

III. *a.* A group of cases of *amaurosis affecting only one eye, in which sight is usually regained*, but in the majority of cases with more or less of pallor or atrophy of the disc. When seen in an early stage there is often, perhaps generally, some evidence of intraocular neuritis; this is, however, often but slight, and in some no changes have been detected.

In one there was a history of partial temporary deafness on the same side; in another paresis of the corresponding external rectus accompanied the amaurosis, and in two others (women) there was a history of temporary paraplegia and hemiplegia many years before.

In nearly all the cases severe neuralgic pain accompanied the failure of sight; the pain was usually referred to the temple; sometimes to the upper jaw; sometimes to the forehead and eyeball. In some cases it is noted that the pain preceded the failure of sight. The pain was invariably confined to the same side as the amaurosis.

The majority of the patients are under 25 years of age, and only 2 of the number are over 40; 9 of the cases

are in women, and 5 in men. In 8 the left and in 5 the right eye was affected.

One young man attributed the failure to masturbation.

In one or two cases there were symptoms of paralysis of the sympathetic nerve on the same side of the neck.

These cases may perhaps be compared with those in which unsymmetrical paralysis, often temporary, of one of the other cranial nerves takes place, the commonest instance being the affection of the facial nerve known as Bell's paralysis; but there is reason to think that some of the other nerves, *e.g.*, the 3rd and 6th, and perhaps the 5th, are sometimes the subjects of temporary paralysis or paresis, without evident cause, and certainly without syphilis.

In some, probably the amaurosis was a symptom of impending ataxia.

Case 197. G. 170. Edwin P., 19.

Neuritis of L. only, with moderate defect of V., and no other symptoms whatever.

Slight temporary deafness in same ear a short time before.

Narrowing of palpebral fissure of same eye, but thought to have been always present.

Recovery of nearly perfect V. with pallor of O.D., and evidence of considerable choroidal change around it.

No syphilis.

History of insanity in several male members of family.

Case 198. F. 103 and O. H. R., viii, 497 (Pt. III). Evan T., 15.

Neuritis or neuro-retinitis in R. eye only, followed by atrophy of disc, and moderate diminution of arteries.

V. at first = 14 J. and $\frac{20}{200}$.

Gradual improvement to 6 J. barely.

Condition same $5\frac{1}{2}$ years later.

The failure at first accompanied by severe pain in same side of face (intraorbital region).

R. p. acts with L., but not alone.

Case 199. C. 51. Anne B., 21.

Failure of V., with advanced pallor of *y.s.* side of O.D. in L.

only, coming on in about three weeks, during an attack of severe pain in the L. forehead.

V. = 1 J. puzzling out the words, with L. eye.

R. eye; O.D. perfect and V. not affected.

Had no pain in R. forehead.

9 years later she wrote that L. was neither better nor worse.

Case 200. C. 250. Walter M., 20.

Failure of R. to 20 J. in association with some pain in R. forehead.

Ophthalmoscopic exam.: negative.

Gradual recovery of V. No cause assigned.

Case 201. C. 253. Janet A., 43.

Neuritis and blindness of L. only; failure of V. coming on very quickly (in 2 days), with severe pain in forehead. Admitted 3 days after failure began, all but blind.

R. eye perfect.

In one month (under 5 gr. doses of iodide of potassium); V. $8\frac{1}{2}$ (words) barely, and $\frac{2}{100}$; O.D. partially atrophied and artery diminished.

The headache was chiefly on L. side of forehead, but not entirely restricted to it. It began when V. began to fail, not before. It ceased entirely after 2—3 weeks' treatment.

Case 202. ? Neuritis with Vaso-motor Paralysis.

G. 82. Elizabeth G., unmarried, 30.

Failure of L. in about a week down to perception of large objects, accompanied by neuralgia of L. temple. No cause assigned.

Slight neuritis (haze and slight swelling), followed in 3 months by slight pallor (3 observers).

Recovery of V. from large objects to 2 J.

Other symptoms;—Redness and heat of L. ear, and narrowing of L. palpebral fissure.

Case 203. G. 185. Wm. L., 19.

Slight retinitis of R. eye, with paresis of R. external rectus.

Chronic otorrhoea on R. side for years.

Headache in R. forehead for a few days before failure.

Perfect recovery of the external rectus under iodide. Slight doubtful traces of retinal mischief remaining.

No syphilis.

Case 204. B. 249. Huntly D., 19.

Failure of L. eye only, coming on in a few weeks, and remaining stationary (16 J. slowly) for many months. Retina slightly hazy; arteries perhaps slightly too small.

Previously liable to severe pain in L. cheek and forehead not known to be in relation to teeth, but bicuspid carious and liable to ache.

The failure attributed by him to masturbation.

Case 205. Mrs. L., 22.

Rapid failure of L. eye in one week down to no p.l., while nursing sick husband.

Good health, but nervous and hysterical, and complains of a weight at top of head, giddiness, and of difficulty in understanding things.

Slight pallor of O.D.; veins rather turgid and arteries small; but changes very slight. Some pain just over the eye.

History of paraplegia for a long time, after a fall, at æt. 13—14; recovery perfect.

Case 206. Monocular Amaurosis, with Neuralgia.

B. 195. (Seen with Mr. Streatfeild), woman about 50.

20 years ago became blind of L. eye, with severe pain in the forehead and eye during the failure. The pain afterwards became less and ceased.

Now advanced atrophy of disc.; artery visible, but probably diminished.

History of partial L. hemiplegia some years ago. No fits.

Case 207. Amaurosis of one Eye without Changes.

B. 110. Mrs. L., 26.

Failure of R. during one night one week before admission, without other symptoms. V. cannot count fingers. Ophthalmoscopic appearances quite n., excepting fulness of veins.

Occasional convergent strabismus of R.

Has recently had severe hæmoptysis, but does not look in the least phthisical.

Case 208. O. H. R., Vol. vi, p. 273. Miss A.

Atrophy of one optic disc, with much diminution of central vessels, following rapid failure of sight (in 24 hours).

The blindness came on at the same time with paralysis of the corresponding 3rd nerve, and with pain in the same forehead. The pain lasted 3 weeks.

Conjectured descending neuritis affecting optic and 3rd nerves.

Case 209. Miss O. (Case occurred several years ago.)

Failure of L. eye only, with extreme dilation of pupil, without ophthalmoscopic changes, and without head or nerve symptoms. No p. l.

Recovery of V. sufficiently to read newspaper, while away on the continent. Subsequently died of phthisis.

Relapse of failure of V., with dilated pupil, on return to England; *with pallor of disc.*

Patient phthisical.

History of a short attack of hemiplegia 3 years before the amaurosis; and of diplopia (but no squint) when V. began to fail.

Case 210. B. 198. Mrs. S., 22.

Failure of L. eye in one night to no p. l., 4 months ago (when 3 months pregnant); scarcely any ophthalmoscopic change (slight haze).

Now pregnant 7 months, with 2nd child.

Health seems perfect, except much uterine sickness during the early months of this pregnancy, but it ceased at about time when eye failed.

Æt. 14 to 16 had a 2 years' attack of paraplegia, ending in recovery with the first appearance of menstruation. The recovery took place without treatment.

Not hysterical.

GROUP XI. B.

Cases of *failure of sight in one eye, with partial or temporary failure of the other, and more or less marked atrophy of disc.* The failure sometimes going on to total blindness, in others partial or complete recovery.

In several of the cases there was pain on the side of the head corresponding to the worse eye. The character and exact seat of the pain, and its relation in time to the onset of the amaurosis, however, vary a good deal.

Case 211. Neuralgia with structural changes in Eye.

G. 289. Thos. R., 36, traveller.

Failure of both rapidly during an attack of severe neuralgic pain at back of neck, and in R. side of head and forehead. Pain in neck "like a bad stiff neck."

There was never any sickness.

L. very soon recovered.

R. remained defective, but gradually recovered (while taking iodide and bichloride) almost perfectly. The pain also ceased.

Subsequent relapse of severe pain and dimness of R.; pain cured by a local application, and V. restored.

On admission. R. A few small opacities in vitreous, and a single speck in lens; slight neuro-retinitis.

1½ year later, O.D. of this eye decidedly paler than other, but vessels of good size.

No evidence of syphilis.

Case 212. G. 375. Lecture Case. Wm. B., 41.

Slowly progressive atrophy, one eye failing many years before the other.

Tertiary syphilis probable.

Case 213. G. 193. Chas. D., 19.

Neuralgia of L. side of head, with stiffness of same side of neck and failure of L. eye.

9 months later;—partial atrophy of L. disc, probably after neuritis. Slight defect of the other eye (enlargement of blind spot outwards).

No syphilis. No rheumatism. No evidence of vaso-motor paralysis.

1876. Now atrophy of both discs and blindness.

Case 214. G. 256. Alfred D., 38. Partial atrophy of R. disc, and considerable defect of V.

Defect probably began several months ago.

Other eye, ? slightly affected, but V. nearly perfect.

History of accommodative failure before definite mistiness began.

Case 215. G. 259. Mrs. S., 45. Slow failure of L. to total loss of p. l., with atrophy of disc, and great diminution of retinal arteries.

Failure of R., beginning some months after L. had become blind, and preceded by symptoms of accommodative failure. Slight pallor of disc, and minute spots of disease of choroid at y.s. (as in early cases of Tay's disease). Improvement of V. of R. after long stay at seaside.

Liable all her life to nervous headaches, and various nervous symptoms; easily upset by worry; but no very uniform or constant symptoms. Has had children.

One daughter went through a severe attack of Grave's disease, at æt. 21. It began a month or two after extraction of some teeth under nitrous oxide. She is now well.

Case 216. G. 398. Mrs. S., 26.

Some gradual failure of L., followed in 2 months by sudden total blindness of R. The latter followed by much severe pain in temples, with disturbed sleep, lasting some months.

The blindness of R. permanent, at first with slight haze of disc and retina, passing into advanced atrophy with considerable diminution of vessels.

The defect of L. (14 J.) passing off in a few months (2 J.). O.D. perhaps slightly pale.

Ps. R. motionless, and of ordinary size throughout. L. at first active; afterwards excessively sluggish, and always remaining rather larger than R.

Various general nervous symptoms (languor, &c.).

No evidence of syphilis.

Case 217. Amaurosis, unequal and with long delayed symmetry, with one-sided Headache over each Eye when failing.

O. H. R., IV, 126, and B., 48-9. Philip C., 35.

At æt. 28, L. began to fail, accompanied for 3 months by severe headache, chiefly over L. forehead. Has since had slighter headaches. L. eye continued to fail slowly for about 6 years,

when it had bare p. l., and same state was noted 9 years later (1871). Blue-white atrophy and shelving cup.

R. began to fail about 7 years after L., with similar pain over R. eye. V. about 8 J., and partial atrophy of O.D. In 2—3 years again had same, R.-sided headache, but eye no worse. 9 years after admission, V. of R. still can see 8 J. Haze and pallor of O.D.

Ps., L. larger than R., and fixed. R. alters in size only when eye is rubbed.

Headache chiefly in morning.

Case 218. B. 53 and 66, and L. H. R., I, 52, Case 25. John P., 24.

Amaurosis beginning in L., and in it advancing to V = 20 J. barely, with pallor of disc.

While under care the R. failing to absolute blindness, without pallor of disc, but with some diminution of retinal arteries.

Patient seen 6—8 weeks after failure of L. began, and remaining under care 5 months.

Great sleepiness; some loss of colour and flesh, but no other symptoms, excepting considerable aching pain in L. globe and orbit when failure began, followed by severe flying pains in L. jaw and face, for which he had a bicuspid tooth out, the fang being inflamed (Mr. Coleman).

Pupils at first sluggish, the L. more so, and rather large. They subsequently dilated, and R. became quite motionless, L. retaining some movement. They dilated at first, while he was taking belladonna, till symptoms were produced, and remained dilated for 2 months afterwards.

Case 219. B. 349. L. H. B. 227. James S.

Æt. 34. Intense pain in L. forehead, preventing sleep, and failure of L. eye to complete blindness in 6 months. Pain ceased when eye became quite blind.

September, 1863. Æt. 38. Failure of R. eye, with severe pain at back of head, and some in front, but not localised in forehead.

May to June, 1864. Æt. 38—9. In London Hospital for pains in back of head, relieved by large doses of iodide.

September, 1865. Æt. 40. Again in Moorfields and the London, with atrophy of L. disc and headache. "R. eye perfect." General health excellent.

October. "Pain almost gone. Black specks before R. increasing."

Gonorrhœa more than once, but no evidence of syphilis at æt. 34.

1870. Æt. 45. L. no p. l. Advanced atrophy of disc, and doubtful evidence of past neuritis. R. V. $\frac{2}{20}$ and 1 J.; slight atrophy of disc.

Case 220. B. 317. Mrs. G., 33. A widow for 7 years.

2½ years ago, severe frontal pain over R. eyebrow, limited to small patch of skin, and persisting for many months, and less often for 2—3 years. Not nocturnal. No sickness.

2 years ago, R. eye began to fail, and became quite blind in about 12 months.

July, 1865. Now, O.D. very pale, vessels normal size. Choroid at O.D. disturbed. No other disease.

June, 1866. Same. P. same as L., and active with L., but not alone. Still subject to violent pain over R. eye. 3 months ago, L. eye began to fail. V. 6 J., close to and about $\frac{2}{100}$. Fundus, n. The same choroidal disturbance about O.D. as in R. Has had no pain in left forehead. P. normal size and active.

June, 1866. V. no worse.

Never before subject to headaches. Habitually scanty menstruation. Cannot bear cold or light to the eyes.

No note as to syphilis.

Case 221. L. H. R. I. 56, Case 37 (and B. 96). Benjamin E. S. Intemperate, and a large smoker.

Failure of both eyes about 6 months.

L. much worse than R.

V. R. = 1 J. barely; L. = 10 J. barely.

Pallor of discs, L. more than R.; also diplopia in looking downwards.

GROUP XI. C.

A small group of cases in which both discs are more or less atrophied, but only one eye seriously defective.

No history of any special neuralgia.

Tertiary syphilis probable in all the cases, and history of other paralysis in one patient.

Case 222. G. 359. (Copied for lecture.) John B., 41.

Atrophy of discs, much more in L. than R.

V. very imperfect in L., good in R.

Syphilis 20 years ago.

Nodes on skull 4 years ago, with only slight headache.

? Atrophy from syphilitic disease of dura-mater, or brain, at base.

Case 223. C. 339, G. 111. J. H., 43.

Amaurosis with atrophy, more advanced in R., 1 month

Slight R. hemiplegia, 3 months.

Extreme myosis.

2 years later R. counts figures.

„ L. V. very good, but discs as before; *both* much atrophied.

History of some defect of V. many years ago.

Syphilis possible 3 years before the hemiplegia and atrophy, but not proved.

Case 224. G. 236. Chas. R., 46, draper's assistant.

Atrophy of discs, much more advanced in R.

Great defect of R. ($\frac{2}{200}$ and 10 J.); noticed 3 months.

No defect of L.

2½ years later, R. (no p. l.) advanced atrophy of disc.

„ L. partial atrophy, but no defect (1 J. easily).

Remotely syphilitic, but no symptoms since the secondaries at æt. 23.

Has very large family.

Shortly before R. failed he was weak and ill and had some vomiting.

Deafness of L. ear from childhood, with otorrhœa.

History of liability to earache and sudden severe pain at back of head on L. side.

GROUP XI. D.

Progressive amaurosis, with atrophy of discs, beginning in one eye considerably before the other and probably ending always in total blindness.

Other symptoms often very slight, but in the case which is taken as typifying the group, as well as in some of

the others, there have been various other indications of slowly-advancing disease of the spinal cord or brain.—(Case 232).

Smoking does not appear to have had any share in the causation.

It is by no means certain that all the cases belong pathologically to the same group, or that further study will not result in distributing them among other clinical groups. A considerable share may probably fall to that of loco-motor ataxy.

Case 225. M. C. T., C. 1, Case 9. Geo. W., 38. Widower since æt. 27.

Very slow failure of V., beginning in L. before R., and progressing to all but total blindness in both in about 5 years (æt. 33—38).

Photopsiæ and variations of sight at first. Atrophy of discs and diminution of arteries. Ps. small, equal, very sluggish.

Had formerly been very liable to epistaxis (a family complaint). Has never smoked at all. No other symptoms.

8 years after admission and 12 years after failure began he was all but blind, but in good health, except occasional giddiness.

Epistaxis ceased some years ago.

Case 226. C. 211. Chas. G., 32. Healthy farm labourer.

Failure of R. began at Christmas; it was quite blind in 2—3 months.

About 1—2 months after R. had become blind, L. failed, and in a fortnight was quite blind.

Some pain in forehead, but not severe, and not coming on till after both eyes had failed.

7 months after commencement of failure of first eye.—No. p. 1. Ps. dilated and fixed. Yellowish atrophy of discs, with moderate diminution of arteries and veins. But little evidence of neuritis, the L., however, being the more suspicious.

Had not smoked for 5 years.

Case 227. C. 239. George B., 38.

Atrophy of discs and amaurosis, more advanced in L.

Failure began 2 years ago and L. was affected before R.
No pain in head. No syphilis. Has never smoked.

Case 228. G. 366. (Copied for Lecture.) Douglas S., 57, a negro.

Neuritis ending in atrophy, with diminution of retinal vessels
Ps. dilated and fixed.

Interval of 11 years between the 2 eyes.

No cause found. No syphilis. Health good.

Case 229. F. 59. Wm. A., a German.

Amaurosis, with atrophy coming on in one several years before the other.

L. began to fail 7 years ago. Quite blind 2 years.

R. began to fail 1 year, and is getting worse.

Blue-white atrophy of both, with slight shelving cup. Arteries a good deal diminished. Ophthalmoscopic condition about the same in the 2 eyes.

No syphilis. Tobacco not mentioned. Good health but getting weaker for 2—3 years. Drinks scarcely any alcohol. Unmarried. Denies onanism.

Case 230. Amaurosis with delayed Symmetry.

L. H. R. I 54, Case 31 (B. 80). Stephen B.

Slowly progressive amaurosis, beginning in L. considerably earlier than in R. and ending in nearly complete blindness, with white discs and much diminished vessels. "Discs opaque."

Much pain in back of neck, and from the beginning great sleepiness.

Admitted 5 years after 2nd eye became blind, and was then in good health.

Ps. sluggish, rather large, and L. rather the larger. Eyes diverge.

No note as to syphilis.

Case 231. G. 147. John P., 25. Notes extend over 2 years.

Failure of V. gradually in both eyes, but progressing at unequal rate in the two, and going on to complete blindness without other symptoms.

Slight neuritis in early stage.

Imperfect action of ps. with atropine; in one eye T. —, and

slight ciliary congestion when first seen 6 weeks after failure began.

A smoker, and never left it off. Risk of syphilis denied. No evidence of hereditary taint.

Case 232. Lecture Case. Mr. W., of P.

Slow failure of R. with, at first, some haze and swelling, followed in about a year by failure of L., at first temporary, but afterwards permanent.

Partial atrophy of discs following many months after the failure of V.

History of tenderness of the eyeballs in the early stage and at one time severe pain in them. Pain behind the eyes.

Other nervous symptoms ;—

“ Stupid ” feeling at back of head. Faintness from hunger.

Cold feet, increasing to numbness of feet and knees, especially R. knee. Uncontrollable movements of leg in the morning.

No alteration of sexual power, but some difficulty in beginning micturition. Sometimes severe occipital and R. temporal headache.

No syphilis.

I believe that ataxic symptoms came on a year or two later.

Case 233. G. 181. Benjamin C., 54.

Failure of L. $2\frac{1}{2}$ years.

„ R. 2 years, or rather less.

Stationary for last 3 months.

Atrophy of discs, chiefly on *y. s.* side, and with considerable choroidal disturbance. Arteries much diminished. V. not noted.

Slight frontal headache and marked diminution of sexual desire since V. failed.

No other symptoms.

Was never able to smoke easily, and used only $\frac{1}{2}$ oz. a week. Continued to smoke this quantity till long after V. failed, when he gave it up. No syphilis. No lead.

Case 234. Slow Amaurosis with delayed Symmetry and no other Symptoms. ? Sexual excess as a cause.

B. 147. John P., 44.

Gradual failure of L. eye during a year or more, followed by

very slow failure of R. during several years, and not beginning till L. had been nearly blind for a year or more.

Ultimate total blindness, with atrophied discs, and no great alteration of vessels.

Myosis at first: subsequently, when quite blind, ps. of ordinary size, but sluggish.

The failure of V. accompanied by great contraction of fields.

No clue to cause excepting great sexual excesses, but without telling upon his general strength.

Case 235. M. C. T. Case 21, and B. 203. Thos. C., 46.

Failure of both, but not synchronously.

L. failing 5 years, and blind 3 years.

R. blind 6 weeks.

Atrophy of both discs. L. much more than R.

Myopia.

Excessive sexual indulgence formerly, and drank and smoked freely.

At present sexual system nearly in abeyance; testes flabby; considerable varicocele.

No evidence of syphilis.

8 years ago had a fit, followed by temporary partial hemiplegia. Often has giddiness.

Case 236. C. 366 and O. H. R. VII, 177, Case 11. Samuel B., 61.

Gradual failure, beginning in R. several mos. before L., and remaining more advanced in it; becoming stationary in about a year. Atrophy of discs; more in R. than L.

No other symptoms.

Died suddenly; æt. 63; no details.

Case 237. L. H. R., I, 55. Case 35, and B. 81. Robert T., 59.

Amaurosis beginning in L. 6 months before R.; subsequent improvement for a time followed by relapse. Failure began 2 years before admission, when he was also under treatment for giddiness to which he had long been subject. Habitually very sleepy, but perhaps only from his occupation (musician).

Ps. smaller than n. and quite motionless; L. larger than R.

Free smoker and drinker.

Case 238. O. H. R., vol. iv, p. 241. Richard B., 36.

Temporary loss of sight in both eyes, with a week of severe

headache. One eye remaining permanently very defective, the other recovering perfectly.

5 years later;—Headache, epileptic fits, and loss of sight in the second eye, without changes. Gray-white atrophy of the first eye: no changes whatever in the second.

Case 239. Peter P., 62.

Progressive failure of both, but R. worse than L.

V. remaining stationary at about 16 J. with R., and 12 J. with L., with + glasses, during his 6 months' attendance.

Pallor (decided) of R. O.D. L. shows scarcely any changes.

No symptoms of disease of cord or brain.

Ps. equal and act fairly.

Perhaps a tobacco case, for failure stopped when he came under care, and nearly gave up smoking. But if so, it is unusual in the imperfect symmetry.

Case 240. Mr. J., 48, shoemaker.

Amaurosis, with interval of a year or more between the eyes, going on to no p.l. Failure rather rapid (about 3 months). Atrophy of discs and great diminution of arteries; R. paler than L. and with more changes, suggestive of neuritis.

Health good throughout.

Spare, nervous; formerly very subject to epileptic fits; none for last 3 years. A nephew had fits. No sexual failure or symptoms of ataxy. Much frontal headache when second eye failed. Very susceptible to cold on his face; it causes a shooting pain which passes down neck; much feeling of cold down back. Never sunstroke or injury to head. No syphilis.

Case 241. C. 261. Wm. G., 56.

Progressive failure of V. 9 months; unequal in the two eyes. R. the worse, and V. in it reported to vary on different days. The R. also subject to attacks of redness (or ecchymosis?); a number of large ecchymoses on admission.

Subject to pain about R. orbit.

Atrophy of discs with diminished arteries and veins; much more advanced in R.

Ps. very small and nearly fixed.

V. R. $\frac{20}{200}$ and words of 18 J.; L., $\frac{20}{70}$, and words of 8 J. badly; improved by + glasses to $\frac{20}{80}$ and 4 J.

Health good.

No note as to syphilis.

Has been deaf 15 years.

GROUP XII.

Embolism.

Case 242. John B., 63.

Atrophy of R. O.D. only, and great defect of V. Found out about a year ago, but may have been as bad for some time. Arteries very small.

L. good.

Case 243. B. 282 (probably published in one of the Journals at the time). Alfred B., 18.

Sudden and nearly total blindness of L. eye; 7 months later advanced pallor of disc, arteries extremely diminished, and those to the (real) lower part invisible; veins diminished to about half.

History of a transient attack of total blindness, lasting only a minute or so, in other eye 2 or 3 months after the permanent attack in L.

Heart's action tumultuous, but no bruit.

No doubt embolism of arteria centralis retinae.

Case 244. A. 2, 161 and B. 23. Richard W., 54 (1862-3).

Sudden failure of left, followed by atrophy and diminution of vessels.

Nearly blind.

Subsequent sudden partial hemiplegia.

Probably embolism of central artery or some branches.

Case 245. F. 83. Wm. K., 38.

Sudden failure of L., 3 weeks. V. returned in 2-3 hours, and remained good for a week.

Second failure, during sleep, 2 weeks.

Ophth. appearances of recent embolism. V. 20 J. barely.

2 weeks later (4 after second failure) retinal haze had disappeared. V. 19 J. barely.

Loud systolic bruit at base of heart. History of rheumatic fever 20 years ago; and of scarlet fever followed by some rheumatism 5 months ago.

Case 246. G. 357. John B., 45.

Embolism of some branches of R. arteria centralis retinae.

Absolute permanent blindness.

15 months later embolism of L. arteria centralis.

Fit 2 weeks before second embolism.

(Two drawings made, by Burgess, of the eye first affected, at different stages.)

Case 247. G. 4. Isaac B., 71.

Atrophy of R. disc, and V. = shadows. Arteries somewhat, but not much, diminished.

History of sudden onset 20 years ago, the eye becoming blind in a day.

L. eye nearly perfect.

Probably embolism.

R. p. small, and does not act to light : acts to atropine.

L. p. active.

Striæ in both lenses.

Case 248. C. 266. Albert L., 26.

Neuro-retinitis of R. only, affecting chiefly the (real) lower and outer part of retina (towards *y.s.*). Corresponding defect of field.

Dimness noticed 4 weeks.

L. perfect.

Ps. equal and active.

Possible syphilis 2 years ago.

? Embolism of a branch of art. cent. retinae.

GROUP XIII.—SUSPECTED HÆMORRHAGE INTO OPTIC NERVE.

Probably hæmorrhage into optic nerve sheath or into the substance of the nerve, or aneurism pressing on the Nerve.

Case 249. History of Temporary Paresis of Sensation in the Right Fifth Nerve: Sudden Failure of Left Eye, rapidly passing into Total Blindness: no Disease in the Eye-ball itself: Diagnosis, Effusion of Blood into Left Optic Nerve-sheath.

B. 44 (already published in one of the Journals).—Mrs. U., aged 54, was admitted July 1862. She was healthy-looking, and had never been ill before—never in bed a day. She was not

liable to giddiness, but now and then to a little swimming. All of a sudden, six or seven weeks ago, she had numbness of the right side of the upper lip, cheek, and side of the nose. The skin felt dead. When she went into the air, it felt as if she put her whole face into ice. This troubled her so much, that she used to cover her face with her handkerchief when she went out. At this time she had great difficulty in keeping her hands warm; they were always cold. Her feet were not cold. At present she has quite lost these symptoms, and her hands are warm. Her legs then swelled; they had never done so before, and were quite gone down when she was admitted. Suddenly, a week ago, whilst sitting at work one afternoon, she noticed a sort of dimness before her eyes. In trying them, she found the dimness was before the left only. In the course of a few hours, the dimness had advanced to total blindness of the left, and she had no perception of light. There was no giddiness, sickness, or other cerebral symptom. Her appetite was good. She was active, and always rose at five.

When admitted, she could not with the left eye see the sun or distinguish the window. The other eye was perfect. The left pupil was a little larger than the other, and quite motionless; it dilated to thrice the size of the other when the other was covered, and remained quite fixed; contracting immediately on light being admitted to the other; under atropine, it dilated well. The media were clear; the vessels of the retina were seen clearly; the veins were rather large; the arteries small. The optic disc was normal and the yellow spot healthy.

Diagnosis.—Effusion of blood into the optic sheath, or else an intracranial aneurism pressing on the nerve.

Case 250. B. 27. Alexander N., 59. January, 1862 or 1863.

Sudden amaurosis of R.; a few days later, pallor of disc and very slight haze of retina; *y.s.* normal; retinal blood supply not extremely deficient, indeed nearly as good as in other eye.

20 years ago had some sort of fit.

? Embolism.

? Effusion or hæmorrhage into sheath of O.N.

Case 251. G. 118. Wm. L., 66.

Probably embolism of arteria centralis far back in optic nerve, or hæmorrhage into optic nerve.

Atrophy of disc and changes at *y. s.* Great diminution of arteries, but they remain pervious.

V. counts fingers.

Bleeding from throat or lungs while under care, without apparent reason.

IV. *c. Neuritis in Secondary stage of Acquired Syphilis.*

Case 252. Lond. Hosp. 1871, pp. 178, 327. Benjamin J., 26, a marine discharged from the service as incurably blind $1\frac{1}{2}$ year before coming to Moorfields; (probably for iritis).

Double neuritis, worse in one eye, $2\frac{1}{2}$ years after primary syphilis treated by mercury to salivation, and 2 years after well-marked secondary disease with iritis.

The neuritis ("white woolly" discs), accompanied by opacities in each vitreous, and by peripheral choroiditis of superficial character.

He improved under iodide from 4 J. (with better eye) to $1\frac{1}{2}$ Sn. and $\frac{2}{8}$ in 6 weeks, while the neuritic lymph became partly absorbed. The worse eye (20 J.) is not separately noted as to vision after first note.

Case 253. Neuro-retinitis causing blindness in Secondary Syphilis.

C. 360. Wm. R., 24.

Amaurosis (p. l.) and atrophy of discs with some remains of lymph still present, 3 years after failure.

Failure rapid (in 1 week) after several months of severe headache and during secondary syphilis. (Chancre, about 6 months before failure of V.).

Case 254. Double Neuritis in Secondary Stage, probably without Gumma.

C. 320. Jane O., 32. Acute double neuritis, swollen discs, opaque effusion extending for a little way into retina; extravasations. "Sight dim." Iodide of potassium. In $2\frac{1}{2}$ months V. perfect again; in 5 months, neuritis almost gone, still remains of lymph. She had had syphilis severely 18 months before. Attended me first at Skin Hospital for tubercular secondary syphilide.

No cerebral symptoms.

Case 255. C. 231. Philip R., 46, a sailor.

Results of syphilitic neuro-retinitis.

Atrophy of discs.

Failure of L., 15 months, or more.

„ R., 4—5 „

On admission, L. = shadows.

R. = 12 J. barely, and $\frac{20}{100}$.

Ps. very sluggish; L. almost motionless.

Syphilis fully 18 months ago, and was salivated for it. Now no signs of syphilis.

GROUP XIV. — NEURO-RETINITIS DUE TO LEAD-POISONING.

Case 256. B. 25. Ludwig H.

Amaurosis, symmetrical, beginning 2 years ago, in a man who had worked 3—4 years in lead factories, and had several times during that period been laid up for many weeks at a time with lead symptoms (colic and constipation; never paralysis).

Can see large objects dimly; R. rather worse than L.

Case 257. B. 345. Ellen N., 32.

August 31, 1865. Duration about 2 months. Coming on while ill with symptoms of acute general lead poisoning; pains in limbs, colic, dry retching, loss of appetite, severe headache (chiefly frontal), paresis and numbness of L. hand and both feet.

Can scarcely tell light from dark. Discs pale, and their margins milky, but not much swollen.

In 2 months, the numbness had quite gone, and sight improved to 20 J. with the better eye.

In 15 months, the better eye saw 18 J. held close; the worse eye 20 J. also very close.

IV. *e. Sudden symmetrical amaurosis, or hemiopia, without changes.*

Probably central cerebral hæmorrhage, or embolism.

Case 258. Bag. David J., 54.

A senile-looking letter carrier. Sudden symmetrical failure of V. down to shadows in a few hours without a single head symptom. Imperfect action of internal and external recti.

Ps. sluggish, and R. rather the larger. Ophth. negative.

Unaccountable differences of V. on different days. Manner hesitating and slow.

Great defect of visual fields, with tendency to hemiopia.

V. no better a year later.

Malingering suspected, but afterwards given up.

Probably hæmorrhage, or embolism of optic centres.

Case 259. B. 284. Fredk. B., 32. Sailor.

Probably feigned amaurosis.

Sudden failure of both eyes, in one night, on board ship, so that he had to be led about.

10 months later V. only letters of 20 J., but can tell time by clock.

No ophthalmoscopic changes, unless slight pallor of *y.s.* side of R. O.D.

Case 260. C. 262. John D., 64.

Failure of both in half an hour, down to counting fingers; coming on in the morning whilst at work (cutting turf), and accompanied by giddiness. Had to be led home. 3 weeks later. V. just the same; cannot count fingers easily. Ophth. exam. negative.

Ps. medium size.

Health good.

The evening before the failure, he had been cleaning a very offensive cesspool, and attributed the failure to it.

Case 261. G. 254. Mrs. S., 51.

Sudden loss of V. ("like a flash of lightning") 18 months ago, whilst engaged in cooking. Since then occasional temporary improvement, but never to any great degree.

Now, R., no p. l.

L. shadows.

Slight pallor of discs.

From childhood subject to sick headaches; worse last few years. No distinct attacks of loss of V. with the headaches, but history of "dizziness." Still subject to great pain, chiefly frontal.

During the last 6 years had had several fits, with temporary hemiplegia of face.

Menstruation regular since æt. 9.

No strong evidence of syphilis.

Case 262. F. 74. Saml. C., 52 (from Dr. Sutro).

Vertical hemiopia, patient's L. half of field being very defec-

tive (= shadows), while with R. half he can read 2 J. easily, unaided.

The extreme periphery of the defective part seems to see better than the more central part.

It came on, with giddiness, one morning about 3 months ago. Felt confused as if after drinking. No other nervous symptoms.

Good health. No syphilis.

GROUP XV. — AMAUROSIS AFTER ERYSIPELAS OR HERPES ZOSTER.

Case 263. Neuritis in Erysipelas of Head.

B. 231. George M., 59.

Had erysipelas of head 15 months before admission. When he recovered was nearly blind for a few weeks; then one eye (the R.) improved till he could read with it, and again failed.

When I saw him, the L. eye was quite blind, the disc white, its sheath much too conspicuous, "uneven and fluffy," the retinal vessels represented by bloodless white lines, and the retina showed abundance of small white dots.

With the R. he could barely see 8 J.; there was no ophthalmoscopic change, except too great conspicuousness of the sheath.

A year later his sight was no worse, perhaps a little better.

Case 266. O. H. R., V, 207, C. 98. Maria L., 50.

Amaurosis with pallor of O.D., with ptosis and mydriasis, ulceration of cornea and doubtful iritis, in severe herpes frontalis et nasalis.

The ptosis afterwards nearly disappeared, but the mydriasis and defective sight remained.

GROUP XVI.—AMAUROSIS IN ASSOCIATION WITH UTERINE OR OVARIAN DISEASES; PREGNANCY, &C.

This small group contains several cases in which the relation between the amaurosis and some special condition of the sexual system is perhaps open to doubt.

In the first 3 cases, however, there seems reason to associate the failure of sight with some peculiarity of the system shortly after parturition and while suckling.

In two of them there was the history of a temporary failure after a previous confinement, and of other nervous symptoms.

(See also Case 23.)

Case 267. Amaurosis during Lactation.

B. 152. Mrs. T., 28.

Failure of V. 6 weeks after confinement; confinement 6 months ago. R. eye suddenly became worse a few days ago; its disc paler than L., and arteries much smaller than natural, and smaller than in other eye.

Case 268. Amaurosis during Lactation.

B. 49. Mary F., 39.

Amaurosis without intraocular changes excepting fulness of retinal vessels and some degree of congestion of discs. V. 19 J. barely, better with R. Ps. very sluggish, medium size, L. rather the larger.

Failure occurred gradually soon after last confinement 6 months ago. Had been ill and weak all her pregnancy. Had a good confinement.

3 months ago a fit, followed by partial L. hemiplegia for few days, and V. much worse after it. Was very sick with the fit. 1 month ago a 2 hours' attack of total blindness.

Very sleepy. No albuminuria and no œdema.

For years liable to occasional tingling in L. face, arm, and leg.

Case 269. O. H. R., vol. vi, p. 278. Mrs. C. N., 42.

Gray atrophy of both discs with some diminution of arteries and blindness.

One eye failed gradually 4 years ago, and the other about 2 years later. Severe headache on same side as failing eye, first one side, then the other.

Failure beginning just after confinement.

Temporary failure of sight with insensibility (? uræmic) 20 years before, also after a confinement.

Case 270. F. 330. Mrs. C., 27.

Neuritis followed by atrophy and amaurosis; L. more advanced than R. in all respects.

Ps. R. fairly active; L. scarcely acts at all.

Failure about 6 months or more.

3 years ago, became for 18 months liable to vomiting; it began several months after 2nd confinement, and ceased after the 3rd = 18 months ago.

During 3rd pregnancy, history of spasmodic seizures with temporary loss of consciousness.

Lately, history of many short attacks of loss of speech without loss of consciousness.

No note of exam. of urine.

No note as to syphilis.

Case 271. Neuritis with delayed Symmetry during Lactation.

C. 355. Mrs. F., 23.

Married 2 years.

1st confinement 11 months after.

1 month after it, R. eye failed and was quite blind for a time, then improved. Now (12 months after failure) V. 2 J. and $\frac{2}{5}$ O; disc in advanced atrophy.

10 months after R. failed (*i.e.* 2 months before admission) L. failed. V. not fingers; neuritis well marked.

3 weeks later considerable improvement ($\frac{2}{7}$ O and 10 J.) and much less lymph on O.D.

She was still suckling when admitted.

Case 272. B. 323 (probably published). Mary P., 50.

Total blindness (no perception of light) coming on in connection with very severe headaches at age of 16, and remaining permanent.

Menstruation did not begin till 2 years after the loss of sight: regular but always scanty. Subject to headaches in girlhood.

Within the last 2 years has had two severe illnesses attended with sickness and headache, and in both cases by complete deafness. She can now hear well.

An elder sister, whose menstruation began earlier, has had tolerable health.

Advanced white atrophy, with slightly jagged choroids and greatly diminished retinal vessels.

Case 273. B. 155. Sarah W., 15.

Alternating amaurosis; repeated attacks in both eyes, soon after commencement of menstruation.

More or less complete ptosis.

History of asthenopia for 2 months. Then a sudden giddiness with loss of V. and loss of consciousness for a short time. Another similar attack ending in total blindness of L.

During the next few months occasional giddy attacks and temporary blindness of the R. eye also. Once V. of L. (worse eye) returned for a few minutes.

Ophth. changes very slight; veins full; artery in L. eye too small.

Menstruation continuing regular and free throughout. Appetite good.

Noises in ears.

Case 274. G. 188. Mary Anne H., 19.

Neuritis of both with retinitis extending for some distance. Incomplete atrophy of both discs (pallor uniform all over) without diminution of central vessels.

Permanent defect of V. in one eye, and no damage at all to the other.

History of strabismus at one time.

Patient since menstruation began (æt. 13), liable to attacks of illness, lasting 3 months or more, usually occurring in the summer, and characterised by severe headache (vertex), sickness, and prostration. Has had a "fit" without loss of consciousness. No suppression of menses.

The neuritis occurred during one of these illnesses.

Extreme anæmia. History of œdema of one leg and some affection of heart and one lung.

History of "fits" in a sister.

„ "sunstroke" in a brother.

„ nervous headaches in another sister and in mother.

Case 275. B. 71 and L. H. R., I, 53. Case 29. Mary Anne G., 19.

Amaurosis gradually coming on for 1 month; symmetrical.

General anæmia and history of former œdema of feet.

No changes in eyes, except anæmia, proportionate to that of the body generally, and slight retinal haze.

Very severe occipital headache. Drowsiness.

Ps. moderate size, equal, fairly active.

Case 276. Amaurosis with delayed Symmetry and Choroidal Disease.

C. 270. Mrs. W., 52.

L. failing more than a year; bare p. l. for last 6 months. Atrophy of disc; vessels of fair size.

R. slowly failing, but not so bad as L. O.D. not so pale, but central artery smaller than in L. Large patch of abruptly atrophied and pigmented choroid at extreme periphery. No other choroidal disease except a few indistinct spots of extravasation.

Myopic.

Some pain in head, but usually good health.

Failure attributed to cessation of menses.

History of temporary failure of R. during lactation 20 years ago; recovered perfectly. ? Did hæmorrhages occur at that date.

Case 277. C. 213. Mrs. S., 42.

Atrophy of L. disc with diminution of artery, but vein of good size; no p. l.

History that the eye began to fail 2 months before a confinement 6 years ago. It improved after the confinement, but at each succeeding one it got worse. Quite blind 6 months, and is now nursing a baby.

R. V. = 1 J. Hy. about $\frac{1}{14}$.

ENUCLEATION FOR SYMPATHETIC OPHTHALMIA.

By J. CRAWFORD RENTON, M.B., F.F.P.S.G.

Assistant-Surgeon, Glasgow Eye Infirmary.

Sarah McPherson, æt. 58, was admitted into the Eye Infirmary on June 20th, 1877. She stated that in March last she observed the vision of her right eye failing, and this gradually got worse until by the end of April she was unable to distinguish light and shade. About the middle of May pain commenced and has continued up to the date of her admission.

External Examination.—Well marked sclerotico-choroiditis with staphyloma a few lines posterior to the superior ciliary region. Tension + 1.

Ophthalmoscopic Examination.—Owing to muddy state of lens the fundus cannot be illuminated.

Examination of Left.—Sees No. 2, aided with 14-inch convex glasses; as seen by ophthalmoscope the fundus is congested with a few floating bodies in vitreous.

Various soothing applications were employed, but as the pain continued the staphyloma was removed without stitching on July 7th.

July 10th.—Eye quiet; no pain on pressure.

July 20th.—Patient dismissed, to return in a week.

August 1st.—The eye continues quiet, and patient is able to distinguish light and shade. Examination of left the same as formerly.

August 14th.—Patient returned complaining that the vision of her left eye was beginning to fail. The pupil was found to be irregular and dilated irregularly under the influence of atropine. No pain in right eye.

Enucleation of right recommended with atropine drops for the left, and calomel and opium pills internally.

August 15th.—Globe enucleated under chloroform.

August 18th.—Left pupil dilates freely and regularly. Socket of right healing. Pills discontinued and iodide of potassium substituted on account of a certain amount of haziness in the vitreous humour of left.

September 11th.—Patient sees No. 2, aided by 14-inch convex glasses.

The right eye was hardened in a solution of chromic acid, and on making an antero-posterior section of it, the following appearances were noted:—Superior ciliary region atrophied, with cicatricial tissue passing towards it from the point where staphyloma was removed; retina separated entirely, there being a large quantity of lymph posterior to its lower half, while a partially decolorised clot existed behind the upper half; the lens was degenerated into a softened mass into which blood was extravasated.

My friend and senior colleague, Dr. Thomas Reid, kindly made sections through the ciliary region including in them the cicatrix above mentioned. On examining them microscopically with a low power we observed that the cicatricial tissue had passed into the ciliary processes causing partial destruction of them.

One of these sections is represented in the accompanying wood-cut.



A. Cornea. B. Cicatricial tissue passing into ciliary processes.

During the formation of the cicatrix here delineated the ciliary nerves must have undergone a certain amount of stretching and squeezing, and subsequent to that the nerves in the left eye, possessing the same function and composed of similar nervous substances, were reflexly irritated, and an iritis of the worst form produced. On enucleation being performed, and thus the cause of the irritation removed, perfect relief to the iritic symptoms on the left eye was obtained.

Although it is to be feared from the nature of the original disease that the sight of the left eye will, ere long, suffer still, we cannot ascribe that to the wound involving the ciliary region, but rather to the same conditions which produced mal-nutrition of the right eye.

Irritation of the ciliary nerves is mentioned by most authors as a probable cause of sympathetic ophthalmia, and as the microscope demonstrated such to have been so in the case of Sarah McPherson, I have brought it before the profession.

ON MYOPIA.

By DR. E. LANDOLT, Paris.*

MYOPIA is a subject about which not a little has already been spoken and written. Perhaps, however, the last word has as yet by no means been uttered. My personal experience induces me to adopt views which differ considerably from those which are generally held. I venture to hope nevertheless, that my doctrines may add something to the knowledge we possess of myopia, and thus be a contribution towards its more scientific treatment.

Myopia (short sight) is that condition of the eye in which vision is distinct for short distances only, and in which, for vision to be distinct at long distances, concave glasses are required. This condition arises from the fact that the focus of the dioptric system of such an eye falls in front of the retina. In order that the image of an object may fall upon the retina itself, a condition essentially necessary to distinct perception, the object must be approached to the eye until it actually does so fall.

If the object be at a considerable distance the refractive force of the eye must be lessened by a quantity such that the resulting image shall form itself further back upon the retina. This diminution in the refractive power of the eye is precisely what is obtained by concave glasses.

DEFINITION.—*Myopia is the sign of a disproportion between the refractive power and the length of the eye.*

We may either say that the myopic eye is too long as regards the focus of its dioptric apparatus, or that the dioptric apparatus is too powerful as regards its length.

This disproportion need not be great in appearance in order to produce a degree of myopia tolerably high. Thus I have shown by calculation that each millimetre of increase

* Translated by Dr. Litton Forbes.

in the distance which intervenes between the retina and the focus produces a myopia of 3.3 D. (old system $\frac{1}{12}$). If, for instance, the retina be situated at one millimetre behind the focus of the eye, we have a myopia of 3.3 D.; in other words, the eye for distant vision requires — 12, and can only see clearly at 12 inches. If the retina be separated another millimetre from the focus, the individual will see clearly only at a distance of 6 inches, and will require — 6 or 6.5 D. A separation of three millimetres between the focus and the retina produces a myopia of $\frac{1}{4}$; that is to say, that the individual requires concave glasses — 6 of four inches focus, and can no longer see clearly beyond 4 inches.

When we seek to explain how it is that this disproportion between the length and the refractive power of the eye is produced, we are seeking, in fact, the *cause of the myopia*.

I recognise three special causes of myopia.

1. An eye may be absolutely sound in all its parts; its functions normal, its cornea and crystalline correctly formed, its membranes healthy, and its accommodation perfect, only the whole eye is slightly too long. In other words the focus of its dioptric system is situated in front of its retina, instead of actually upon it. There is nothing surprising in this if we consider the slight increase in length required to produce myopia, and if we further consider that there exists a much greater number of eyes in which, independently of any morbid cause, the focus is situated behind the retina, such eyes being hypermetropic, or having too long sight. Nay, the wonder would rather be if all eyes were so regularly developed that the foci of their dioptric systems always fell exactly upon their retinae.

Eyes which suffer from this form of myopia are not diseased. They are, indeed, to the full as healthy as the eyes of hypermetropes or emmetropes. With the aid of proper correcting lenses, they can distinguish objects at

considerable distances quite as well as normal eyes, and at short distances without the aid of any glasses. Such eyes especially bear close work easier, and for a longer time than normal ones, precisely because by their constitution they are already adapted to short distances, and can consequently see with little or no accommodation.*

The public is possibly better acquainted with this class of shortsighted persons than are oculists. Such persons belong to a class which in youth selects its own correcting glasses, and wears them continuously, perhaps even uselessly, for reading and writing. As age comes on, and the accommodation begins to grow weaker, these myopes use their concave glasses only for distant vision; near objects they see remarkably well without any glasses, whilst normal eyes at the same age have become presbyopic and require convex ones.

This variety of myopia is not, fortunately, so rare as might be supposed from books. But, as I have said, it is characterised by one feature, namely, that the affected eyes present nothing abnormal, either externally or internally. They can see distinctly at a distance with proper correcting glasses, and they also can see near objects without fatigue. This explains why an oculist so seldom has the chance of meeting with such patients. If, however, they do consult him he is struck by the precision of their answers as regards the choice of glasses; unless indeed their myopia happens to be complicated with astigmatism. They will at once single out the glass that suits their myopia, refuse any that are too weak, and still more emphatically any that are too strong. Furthermore, the degree of myopia shown by the ophthalmoscope will generally agree with the glass which the patient has chosen.

This variety of myopia is often congenital. It has little or no tendency to increase. It cannot be cured, that

* They distinguish details which are imperceptible to a normal eye, because they receive larger retinal images.

is to say changed into hypermetropia, which, moreover, for low degrees, would scarcely be desirable.

2. The second form of myopia is due to spasm of the ciliary muscle. In consequence of this the lens becomes more convex, unites parallel rays in front of the retina, and adapts the eye to divergent rays, that is, to objects situated at shorter distances.

This form of myopia is met with chiefly in early youth. Those suffering from it cannot see at a distance, except with the aid of concave glasses. They generally work at near objects, without glasses, and are inclined to bring objects very close to their eyes. Contrary to what is observed in myopes of the preceding category, they complain of fatigue, of a sensation of smarting in the eyes, of headache, and, in a word, of the symptoms of asthenopia. In such cases it is not uncommon to find an insufficiency of the internal recti muscles. When you come to select glasses for these patients, their answers lack precision; they choose glasses that are too strong rather than too weak, even though the former do not improve in any degree their visual acuity.

If we determine the amplitude of accommodation in such an eye, and compare it with the degree of myopia present, it will appear extraordinarily weak, until the determination of the refraction by the ophthalmoscope yields an explanation of the phenomenon. During the ophthalmoscopic examination, the eye relaxes its accommodation, as it does on every occasion when an object is not being fixed (as, for instance, during sleep); then it reveals its true refraction. In such cases we are consequently often surprised to find a degree of myopia much lower than what was apparent from the trial of glasses; nay, we may actually have emmetropia or even hypermetropia.

This form of myopia may be cured by a course of atropine rationally carried out, and combined at times with the use of convex glasses and prisms. I have succeeded in curing many such myopes. I may here cite a

typical case which recently came under my notice. It was that of a youth, aged 16, who had distinct vision for distance only with the aid of D 6, and who, without glasses, could not see any of the large test-types. His myopia had increased with considerable rapidity. He used of his own accord glasses for work, and made marked complaints of asthenopic pains. He was very much alarmed at the idea of his myopia getting progressively worse, as had been the case for some years past. The ophthalmoscope revealed the fact that there was no myopia at all; but on the contrary, rather a slight degree of hypermetropia. A course of atropine was immediately commenced, and the myopia cured. The headaches and fatigue of the eyes disappeared, and at the present time the patient can see at a distance without glasses, and can accomplish near work without fatigue.

Such cases are veritable victories, due solely to the ophthalmoscopic determination of refraction. Doubtless atropisation might have led to a diagnosis, but then it is no pleasant thing for the patient, in order to obtain exact results, to have his accommodation paralyzed during several days, and, as we know, thorough paralysis is essential to a knowledge of the true state of the refraction. Hence, perhaps, an oculist who is unable to diagnose a spasm of accommodation by means of the ophthalmoscope, will scarcely venture, and for good reasons, to propose a course of atropine to his patient. On the other hand, he who has mastered thoroughly the refraction of an eye both when in repose and when fixing an object, and who knows the difference between the respective conditions, may with confidence assure a patient that the symptoms he suffers from will be removed.

3. Myopia may be produced by a disease of the eye, by choroiditis.

The choroid placed between the retina and the sclerotic forms the major portion of the uveal tract (the iris, ciliary body, and choroid). It forms more especially the mem-

brane of nutrition for the eye. Should it become the seat of any alteration, the whole globe may sympathise with it.

Let us review the group of phenomena which characterize choroiditis, an affection which has been with very little reason divided up into different diseases, and called by different names, but which is essentially one disease, exhibiting itself under a variety of forms.

Choroiditis begins by hyperæmia of the choroid, and nearly always of the optic nerve. Then follow exudations under the retina, into the retinal tissues and into the vitreous humour. While the retinal exudations sometimes result in detachment, those into the vitreous become a cause of increased intra-ocular tension, and of opacities. Simultaneously with the above changes there is noticeable an alteration in the disposition of the pigment. From some localities it disappears; in others it is heaped up, in the form of dark-coloured patches. The nutrition of the crystalline and vitreous is thereby impaired; the latter becomes in many cases fluid, as all know who have had to operate for cataract on eyes of this kind; a by no means uncommon occurrence, inasmuch as the crystalline often becomes opaque from this very cause. Similarly and for the same reason, the zonula of Zinn may atrophy in part, and under the influence of the traction exercised upon it as the result of an increase in size of the globe, may be ruptured. In such cases we have a dislocation of the lens, and its escape into the fluid vitreous. Owing to the exudation into the vitreous, intra-ocular tension is necessarily augmented.

But as I have already said, the sclerotic, which is so intimately united with the choroid, participates in the pathological process. Its tissue loses all power of resistance; it yields, stretches, and becomes translucent in parts, as may be seen every day in eyes affected with choroiditis of the anterior portions of the globe, and more especially with cyclitis.

The sclerotic, thus vitally altered, yields to the in-

creased intra-ocular tension. Hence the reason that this increase of tension is seldom revealed by tenometry.

If the choroiditis is seated anteriorly, we have ectasie of the anterior portions of the globe; if posteriorly, of the deeper portions of the eye, constituting the so-called posterior staphyloma. The retina covers the staphyloma like a carpet, and necessarily yields along with the other membranes. Now, if the retina was at some former period situated in front of the focus of the dioptric system of the eye, if, that is, the eye was hypermetropic, the hypermetropia in every case grows less in consequence of the displacement of the retina, which has now receded towards the focus. When the retina has arrived as it were actually at the focus, the eye has become emmetropic; when it has passed beyond it, myopic. Such a myopia will be high in degree, exactly in proportion as the choroiditis has developed itself in an eye which was long to commence with. The ectasia of the sclerotic can spread to the equatorial regions of the globe; nay, even to the entire globe. Still, whatever has been the nature of the lengthening process, whether limited to the posterior pole or implicating the entire globe, from the moment that the eye has become longer than the focal length of its dioptric system, it has necessarily become myopic. Thus then we find myopia is, in this case, the consequence of a deep-seated affection of the eye. This myopia will be progressive, because the choroiditis is progressive.

Other and subjective symptoms are not wanting; sensations of tension, especially at the fundus of the orbit, of phosphenes, of *muscæ volitantes*, of diminution in visual acuity. Asthenopic troubles of every kind, even scotomata, may result from this very treacherous affection.

Do not the pathological disturbances just enumerated tally exactly with the symptoms laid down in the text-books under the head of "pathology of the myopic eye," as peculiarly characteristic of myopia? The anatomy is after all simply that of an eye which has become the

subject of choroiditis, and which may often be myopic, but not always necessarily so. Indeed it is no rare thing to find the same anatomical lesions in a hypermetropic or an emmetropic eye.

In fact the supporters of the current theory, which considers myopia as a specific disease, are not a little embarrassed when it comes to be a question in a hypermetropic eye of explaining the presence of a staphyloma posticum, with pigmental changes at the fundus. To the advocates of the theory such changes are among some of those most characteristic of myopia. According to my view I find nothing surprising in these symptoms. Choroiditis may develop itself in any eye whatever, quite apart from its length or refractive power.

As regards the therapeutics of this variety of myopia, they must necessarily be those of choroiditis. We must, and this is peculiarly important, remove all sources of irritation from the inflamed membranes. We must endeavour, as in all inflammations, to avoid congestion, especially of the head and affected organ, together with excessive light and excessive fatigue of the eye or the accommodation.

The muscle of accommodation, indeed, forming as it does an important part of the uveal tract, may, if unduly or too often put upon the stretch, exert a pernicious influence upon the choroiditis, and thus indirectly become a cause of the myopia. But the accommodation is not, as some have maintained, a primary cause of myopia. Were that the case, then all the hypermetropes who make much greater demands upon their accommodation ought within a given time to become myopes.

It is not the myopia *per se* which, through the medium of the accommodation, leads to staphyloma, but it is rather the accommodation which by aggravating the choroiditis leads to staphyloma with progressive myopia. Therefore it is that in this variety of myopia close work and the use of glasses may become injurious, only, how-

ever, when the latter are too strong, for the distance for which the patient uses them, for then it is that they fatigue the accommodation.

Derivatives of every kind may be considered as indicated in cases of choroiditis, but not of myopia as a rule. Moreover, when it becomes a question of guarding against or curing this particular choroidal form of myopia, it is of the first importance to know the cause or causes of the choroiditis.

Recapitulation.

I recognize three varieties of myopia :—

1. The myopia of an eye perfectly healthy.
2. Functional myopia, due to spasm of the accommodation.
3. Myopia, symptomatic of a disease of the eye, of choroiditis.

The proofs on which I found the explanation I have given of myopia are furnished in abundance, both by clinical observation and by pathological anatomy.

Some of the causes of myopia as given by authors will apply to one or other of the above varieties. There does not, however, exist any uniform and specific cause of myopia, precisely because myopia is not a disease. It is only the sign of a disproportion between the length of the eye and the refractive power of its dioptric system.

An excessive development of the cranium antero-posteriorly, a marked depth of the orbital cavity, may be connected with the first variety. For spasm of the accommodation we must, on the other hand, seek another cause. Fatigue and dazzling of the eye, insufficient illumination, hours passed in unhealthy schoolrooms, a faulty position of the body, the abuse of concave glasses, may all conduce indirectly to the third variety. That is to say, in eyes either predisposed to choroiditis or already attacked by it, myopia may be produced or aggravated by causes similar to the above. Thousands of

eyes, on the other hand, are daily exposed to like influences without becoming myopic, and that because they are not suffering from choroiditis.

If we come to seek out the causes of the essentially progressive or malignant form of myopia, we shall find they are explained reasonably and consistently by the presence of choroiditis. These causes will in the vast majority of cases be of constitutional origin. If we direct our attention to the matter and enquire carefully into the nutritive condition of an individual with choroiditis, we shall often find a condition of low vitality and a feeble and strumous constitution. This applies not only to the individual but to the race. If to this be added excessive and long-continued fatigue of the eyes, choroiditis will become further developed, and may lead to progressive myopia.

ON REFRACTION OPHTHALMOSCOPES.

[From a Lecture, with Demonstrations, at the Berlin Physiological Society,
on the 15th June, 1877.]

By Dr. J. HIRSCHBERG, of Berlin.*

I. IT is well known that Helmholtz, already in his first publication on ophthalmoscopy (1851), has pointed out distinctly that his method (viz., that of the erect image) enables the refraction of the examined eye to be objectively determined (cf. Helmholtz, "Physiologische Optik," p. 176, seqq.).

The original instrument† of Helmholtz does not only appear to us venerable on account of its age and merits, but is also optically so perfect that even to this day we sometimes use it, and could wish that all the inventors of recent instruments had kept that pattern more steadily before their mind's eye. The mirror, consisting of simple, uncoated plates of plane glass, is fixed obliquely so that the visual axis of the observer coincides with the principal axis of the correcting lenses. The latter are few in number, it is true, but large and firmly fixed in a short tube with proper diaphragm; the eye of the observer is well shielded from side-light by a hollow cup-shaped piece at the back of the instrument. In other specimens furnished by the mechanician Rekoss, of Königsberg, the correcting lenses, eight in number, are fixed in two discs which revolve behind the hole.

II. Also the ophthalmoscope of Coccius which was chiefly employed at the clinique of A. von Graefe—a perforated and silvered plane mirror receiving convergent light laterally through a convex lens—enables the observer in the direct

* Translated by Dr. Samelson, of Manchester. It might be well to state that the MS. of this paper was received in August, 1877.

† My own specimen (bearing the date 1852) is marked Luhme & Co., Berlin, Kurstrasse 51, price seven thalers.

method to look vertically through the correcting glasses which are inserted in small frames sliding behind the hole in the mirror. The like advantage belongs to the large ophthalmoscope of Donders.

III. The instrument, which on account of its low price has been mainly used hitherto by practitioners as well as by medical students, is the so-called small ophthalmoscope of Liebreich, a perforated and silvered concave mirror. It suffices for the inverted image, but is not so well adapted for the erect one, since the observer, with an adequate illumination of the pupil, has to look obliquely through the correcting glasses, which are few in number and have to be inserted in a clip behind the sight-hole.

If despite the exertions of some teachers amongst us as well as abroad the use of the erect image has not yet become so widely spread as, on account of the precision and value of the direct method, it ought to be, the fault lies chiefly with the imperfect instruments which are in general use. The sole object of these short remarks is to draw attention once more to the better sort of contrivances.

IV. Great value attaches to the ophthalmoscope of E. von Jaeger, who led the van, with singular success, in the cultivation of the new method and its regular employment in the estimation of the refraction. His mirror, which has been rendered more handy and compact by Mauthner, is devised in strict accordance with Helmholtz's principles. The reflector, of oblique position, consists of unsilvered plates of plane glass; in its place, however, a perforated and silvered plane mirror may be inserted. Thanks to the slight intensity of the incident light the observed eye is not dazzled and is free to relax its accommodation. Thus the position of its far point is more readily ascertainable than with the strong light of a concave mirror. The latter we cannot dispense with in the examination of the inverted and real, aerial image, whilst of the erect and virtual image we obtain an excellent view with a reflector yielding

a feebler light. It must be kept in mind also that the brightness of the retinal image is by no means commensurate with the intensity of the illumination, owing to the contraction of the pupil induced by the latter. Beginners are often surprised to find that they see better when, having before vainly exerted themselves, they are told to lower the flame of the lamp or remove it to a greater distance. As to the number of the correcting lenses, which are inserted after the manner of Helmholtz, and are of adequate size, it varies in the different makes of the ophthalmoscope of von Jaeger. My own specimen* has a spring clip at the back, in which any of the lenses of the trial case may be inserted. This instrument has served me from the beginning of my own practice in all cases up to within two or three years ago. I frequently use it still, and am of opinion that every observer after a little practice will be greatly satisfied with the like. It is true, the empirical selection of the best lens for correction takes some time, but that is compensated for by the great precision of the image and the exact results of the estimation. Cf. Hirschberg, "Beitraege zur Augenheilkunde," II, pp. 13—33, Veit & Co., 1877.

V. Yet, with the increasing number of his patients, everybody has felt the want of a contrivance that should enable him to go on with his work more expeditiously. Hence, within the last few years, there has been produced a large number of so-called refraction ophthalmoscopes, all supplied with revolving discs at the back of the mirror. In other words, the disc of Rekoss, known from the commencement of the ophthalmoscopic era, has come to be furnished with a more copious supply of correcting lenses. A considerable number of different glasses are inserted in one or several discs to enable any observer by a more or less simple rotation of the latter to find the suitable glass for the erect retinal image in any eye to be examined. By such a contrivance, it must be admitted, something more is gained

* Obtained at the price of 17 florins, from the optician Fritsch, in Vienna, Alserstrasse.

than a mere saving of time. The correcting lens, viz., that lens by which the far point of the observed eye is transferred to the far point of the observer's, and also the refraction of the former determined, is, with such an apparatus, both more readily and more reliably secured than with a Helmholtz-Jaeger ophthalmoscope. This is accounted for by the nature of our senses. The quicker the succession of two sensual impressions—*i.e.*, in our case, the same retinal image successively viewed through two different correcting lenses—the safer is our comparison of them.

The first refraction ophthalmoscopes of the kind, furnished with about 24 lenses, were those of Loring, Cohn, von Wecker, and Knapp (1871, 1872, 1873, 1874). They all yield good and prompt results in practised hands, but are not free from partial defects.

1. The mirror in most of them is concave, silvered and perforated in the centre so as to secure an illumination sufficient at once for the inverted image: but so the light becomes too strong for the erect image. If to counteract this we resort to the expedient of lowering the flame or removing it to a greater distance, an undesirable contraction of the illuminated field on the retina is the consequence.

2. When the pupil is adequately illuminated, the observer has to look obliquely through the correcting lenses; thereby their focal distance, calculated as it is for vertically impinging light, becomes changed and shortened, and, moreover, an astigmatic effect is produced. A concave glass of $\frac{1}{20}$ held at an angle of 45° before my own eyes becomes equal in effect to a concave of $\frac{1}{16}$ held straight. This effect of the oblique position increases proportionally with the strength of the glasses, and in the case of the higher powers renders an exact and ready estimation impossible. Again, the astigmatic distortion of the image, which is induced by an oblique position of the stronger glasses, impedes the sharp distinction of the minuter

details and interferes with the objective diagnosis of an existing astigmatism, which is yet of such great importance.

Oblique incidence of the light is lessened in proportion as the illuminating flame is placed nearer to the straight line which connects the centre of the pupil of the observer's eye with that of the patient's, and it ought, therefore, to be behind the head of the latter, to avoid his being inconvenienced by the heat. This purpose appears to be answered by a freely movable bracket, such as is used at the London eye-cliniques, unless we choose to obtain our illumination by a second plane mirror of small size, reflecting the light of a candle, and fixed near to the eye of the patient.

3. The endeavour to accommodate the entire contents of a case of trial glasses upon the periphery of a circle of the length of 25 mm. involves the necessity of resorting to the very small lenses of 2 mm. diameter. But these are very inconvenient, for the following reasons:—*a.* The natural brightness of an object, whilst not essentially interfered with by being seen through a good-sized glass lens, diminishes rapidly as the diameter of the glass becomes less than that of the patient's pupil (or rather that of the image of such pupil as formed by the corneo-aqueous system), that is, in the proportion of the squares of the diameters. When the diaphragms or correcting glasses are of too small size, part of the light employed in illumination goes merely to dazzle the patient without contributing to the brightness of the retinal image under examination. That the homocentric pencils of luminous rays directed to the pupil of the patient become really narrowed in this wise I readily verify by the fact that, with an instrument sold under the name of "Knapp's ophthalmoscope" when I look through the aperture marked 0, I can make out Snellen's C at 20 feet, whilst with my naked eye, being M_{TT}^{-1} , I can only see CC at that distance.* Dioptric measuring apparatus, however, ought

* Prof. Knapp's own instrument, which he kindly allowed me to use, is free from this defect.

not to be constructed on the principle of the stenopæic aperture (v. Liebreich in Nagel's "Jahresbericht," 1871, p. 161). It is no more appropriate to recommend to beginners a mirror with a sight-hole of only 1 mm., the better to enable them to see the erect image, than it would be to replace the loupe by a dark screen with a fine central aperture. *b.* These small glasses, especially those of high power and in cheap instruments, are but indifferently ground and mounted. From a careful experimental comparison of most of the recently produced ophthalmoscopes I venture to affirm that, with an apparatus which requires the observer to look obliquely through small glasses, it is very difficult, aye, sometimes impossible, to obtain an erect image by a $\pm \frac{1}{2}$ or $\frac{1}{3}$, whereas with a Helmholtz-Jaeger ophthalmoscope the object is promptly and easily attained. It is significant, in this respect, that the two most recently issued Parisian instruments (von Wecker's and Landolt's, by Crétès) do no longer contain any glasses stronger than $\pm \frac{1}{10}$ dioptics, = $\pm \frac{1}{4}$ inch. *c.* Another fault, and that the most telling with beginners, consists in the reflections which occupy one-half or one-third of the field of vision. They are catacaustics springing from the side that happens to be illuminated of the short canal which passes through the mirror and the metal frame. These troublesome reflections may be much lessened by giving that canal a dull blackening with soot in turpentine, which may be renewed at will. But what must be positively insisted upon is, that the canal should be of sufficient width (no less than 3 mm.) and the diameter of the glasses, too, of adequate size. The centre of the mirror may be left unsilvered instead of being perforated, as has been recommended by Liebreich, and observed in the latest Vienna instruments. It deserves to be noted, however, that with continued use the central uncoated portion becomes irregular in outline. I can only say that I have found a small instrument, fitted for the waistcoat pocket, with but 12 correcting lenses of good quality and proper size, which I had made three

years since after the plan of Knapp's, and in which at a more recent period the mirror was placed obliquely, much more convenient and serviceable, both for viewing the erect image and estimating the refraction than a more expensive contrivance with 24 or more glasses of less good quality or position.

VI. As the inadequacy of the small glasses had been repeatedly insisted upon (by Cohn, Knapp, myself), whilst yet certain limits remain assigned to the size of the disc from the configuration of the face, the attempt was soon made to meet these points, without curtailing the series of glasses, by having them fixed in *two discs* revolving upon each other. Thus, by the combination of two different glasses as many as 40, 60, and even 80 different equivalents of correction were obtained. The first who devised such an instrument was Knapp,* and similar are the "metrical" refraction ophthalmoscopes of L. von Wecker and of Landolt.† In the latter the correctives vary by a regular interval of 0·5 from +10 to 0, and from 0 to -10 dioptrics. There is in these latter instruments an almost inconvenient *embarras de richesse* for the minor degrees of ametropia, whilst for the higher degrees they are decidedly insufficient. They do not enable the measure of the extreme degrees of myopia or hypermetropia to be determined, which is yet a matter of so much importance in the examination for military purposes. Again, with two discs correct centration becomes a matter of greater difficulty, and the images obtained, especially with the mirror of v. Wecker, are scarcely satisfactory. In his case, to obtain -0·5 dioptric, the two strongest glasses of the apparatus, *i.e.*, +10 and -10·5, have to be algebraically added. More complete, though no better in workmanship, is the ophthalmoscope of Badal, whilst that

* Arch. f. Ophth. and Otol., vol. iii. The instrument is to be had, at the price of 40 dollars, from Gebrüder Müller, 1223, Broadway, New York.

† Both obtainable from Crétès, 66, Rue de Rennes, Paris, price 40 francs each.

of E. Meyer, of Paris, and a London instrument which I saw there lately at Moorfields, through the kindness of Dr. Gunn, combine greater completeness with superior workmanship. Also, the instrument of Baumeister, in Berlin, is a complete one, and by the substitution of an oblique plane mirror may be freed from those two faults which are admitted by the author himself. It must, however, be allowed that economisation of time and convenience are not amongst the attributes of an instrument which requires re-arrangement at intervals of $\frac{1}{2}$ dioptric somewhere within the range from +14 D to -12 D.

VII. Since I have become convinced by experience that another virtue of the oblique reflector is this, that it enables *beginners* soon to command the erect image, so that with a carefully made instrument of the kind they are even able from the first to discern the upright image, if not to estimate the refraction, my preference is established, although I am far from denying that, with appropriate illumination, equally good results may be obtained by the ophthalmoscope of Knapp, and others of the kind.

Very good ophthalmoscopes, having the mirror thus placed obliquely, and with which I have become acquainted, are the following:—

1. Mr. Couper's, of Moorfields, with a series of discs, and the interval of refraction = $\frac{1}{8}$ inch.*

2. Loring's, improved by Wadsworth, with 24 good correcting glasses of fitly chosen intervals, in one disc, with everything required for the inverted image. This is one of the most elegant of all the ophthalmoscopes that may be considered complete and useful.†

3. Schnabel's, that is, a Jaeger's ophthalmoscope with three revolving discs holding 39 very good lenses in dioptries, and with everything requisite for the inverted image. Brightness of the images, as well as completeness and convenience of the correcting apparatus, distinguish

* Price £7.

† Price 146 marks, at H. W. Hunter's, 1132, Broadway, New York.

this, it is true, as yet somewhat clumsy and heavy instrument.*

A modification of the last-named model is what I recommend as a complete, convenient, and cheap ophthalmoscope, for the use of students and practitioners.

VIII. What we require are from 24 to 36 different glasses ranging, with proper intervals, from $-\frac{1}{2}$ to $+\frac{1}{2}$ or $+\frac{1}{3}$ inch (from -20 to $+18$ D); a lesser number is inconvenient, whilst a larger one is troublesome to manage and unnecessary. 24 glasses (Wadsworth), and even 33 (Knapp), may be satisfactorily arranged upon one disc of moderate size. The object is very skilfully achieved by the reduction of the metallic septa between the several glasses. The workmanship of the American instruments especially excites our admiration; no wonder that they are rather high priced.

Our own pattern comprises two discs, the first holding the following glasses (in dioptries): $+5$; $+4$; $+3$; $+2$; $+1$; $+0.5$; 0 ; -0.5 ; -1 ; -2 ; -3 ; -4 ; -5 ; and the second these: $+6$; $+8$; $+10$; $+12$; $+14$; -6 ; -7 ; -8 ; -10 ; -12 ; -14 ; -16 ; -18 . The discs allow of being very quickly changed, the glasses are readily cleaned. The first disc suffices for the vast majority of cases; for the lowest degrees of ametropia it has the interval of ± 0.5 D.

I. The second disc would then contain the remainder of the above series for the emmetropic observer, omitting perhaps what is superfluous, for instance $+2$ D; $+3$ D; $+4$ D; $+5$ D; $+6$ D; $+8$ D; -10 ; -11 D; -12 D; -14 D; -16 D; -18 D; -20 D.

II. An observer requiring on account of his own ametropia a correcting glass (say of -4 D) for the examination of an emmetropic eye, may have that power for a start inserted instead of zero as the central one, and

* Obtained from Joseph Leiter, in Vienna, at the price of 75 marks. A similar modification of v. Jaeger's instrument had already, in 1874, been made at the direction of Bergh.

the disc further furnished with the glasses +1 D; 0; -1 D; -2 D; -3 D; -3·5 D; -4 D; -4·5 D; -5 D; -6 D; -7 D; -8 D; -9 D. The second disc is required only for the rare cases of high degrees of ametropia.

The apparatus comprises, further, two or three reflectors (*i.e.*, one or two plane and one concave) and two convex glasses (+18 and +12 D, properly ground and mounted) for the inverted image. The concave mirror may be fixed on a separate handle, so that the same eye may be examined for the erect and inverted images without loss of time by unscrewing and refixing.*

After this short review of the instruments, I have still to say a few words on the value of the method, since various authors have raised objections to it and vindicated the preference of the inverted retinal image. On theoretical grounds, as well as from a very extended experience—as I examine every case by both methods—I am bound to differ from that opinion and to adhere to the traditions of the Vienna school (v. Jaeger, Mauthner).

Whoever wishes to have a clear insight into the dioptric condition of an eye ought to view the retinal image which is formed by that eye itself as directly as possible, *i.e.*, in most cases the erect image; in cases of extreme myopia the inverted, as seen without correcting glasses. For whenever a strong convex lens (of from 2 to 4 inches focus) is superadded to the dioptric system of the eye under examination, unless care is taken by means of fixed apparatus to minimise spherical aberration and oblique incidence of the light, that lens has a predominating influence upon the character of the image, and the estimation of the independent condition of the eye is rendered difficult. Already in the old classical treatises on optics we meet with the statement, important in practice, that with a convex lens of short focal distance, the inverted images of all objects farther removed from the lens than ten times

* The apparatus may be obtained from P. Dörrfel, Berlin, 46, Unter den Linden, at the price of 40 marks.

its principal focal distance lie nearly in one and the same, that is, the posterior principal focal plane. Hence in the method of the inverted image the unavoidable error would at the least amount to from $\frac{1}{20}$ to $\frac{1}{40}$ of an inch (1 to 2 D), but in reality it is even greater, owing first to the impossibility of securing and maintaining the best position of the unfixed lens; and secondly, to the optic imperfection of the lenses commonly employed, which are mostly left too thick, so that spherical aberration is not sufficiently guarded against.

Professor Schmidt-Rimpler uses for the inverted image the shadow from a crossed grate of metal in front of the flame, as Coccius (Stimmel) does for the erect image. Whilst the flame placed laterally with the grate before it, as well as the eye under examination with a 4-inch convex lens, held about 4 inches in front of it, remain fixed; the head of the observer, with the concave mirror before it, moves gradually backwards, and a conveniently attached tape-measure with a ratch serves to measure the greatest distance (a) between mirror and convex glass, at which the grate's shadow appears distinct upon the retina's image betwixt the papilla and fovea. Hereupon, whilst the flame and the grate continue unmoved, the distance b is measured from the mirror to the locus of the grate's image formed by the concave mirror alone. The distance $d = a - b$ denotes the refraction of the examined eye, since d in emmetropia is equal to f (that is, the focal distance of the convex glass); and it is less than f in myopia and greater than f in hypermetropia.

Having first worked with the original apparatus as described, I then employed a narrower grate, and simplified the method by omitting the second measurement. Being myopic, I have my far point at a fixed distance β ; any one not myopic may render himself so by means of a proper convex glass placed behind the sight-hole of his mirror. Henceforth a only need be measured and the constant β deducted from it, in order to determine d . Upwards of

a hundred careful observations, with a comparative trial in each case of the erect image, have proved that whilst Schmidt's plan can always be easily and expeditiously accomplished, the latter is yet the more accurate of the two, and affords the additional advantage of a considerably magnified image of the most important region of the fundus. And, again, the grate's image formed by the concave mirror held obliquely is astigmatic, *i.e.*, the horizontal and vertical shadow-lines are not at the same time and distance seen with equal distinctness; so that really in every case a mean ought to be struck between two observations. It is self-evident that, under such circumstances, the determination of an existing astigmatism cannot be an easy matter. The less oblique the incidence of the light upon the mirror, the better are the results, as we have seen before. Finally, we must remember that on account of the strong light of the reflector, it becomes rather difficult for the patient to relax his accommodation.

To such a degree, in a comparison of the direct with the indirect method of examination, the former can certainly hold its own. And now it remains in conclusion, to consider the direct method in regard to its absolute value.

Strict philosophical precision and practical utility are two different things.

A. Mathematically, the method of the erect image is not exact itself, since a loupe, whether a compound convex lens or having, like that of Brücke, a concave ocular, is not, in reality, an adequate means for *measuring distance*.* If with a loupe we obtain a distinct image of an object A, we are not able from the known focal distance f of the loupe to calculate the unknown distance a of the object from the loupe, because we do not know to what degree the accommodation of our eye had been relaxed. Hence neither the older nor the more recent attempts, parti-

* It is different with an astronomical telescope, which, if constructed after the plan of my optometer, and supplied with a mirror placed obliquely, will answer the purpose, Cf. Hirschberg, "Beitraege An.," II, 1877, Veit and Comp.

cularly by military surgeons, to utilise the loupe (after the example of Burow), for the subjective estimation of the refraction have been able to secure the approval of ophthalmologists. Yet it certainly makes a great difference whether the eye, looking through the loupe, is that of a recruit or a random patient, or whether it is that of a *medical observer*: for the latter is certainly able, in a short time (say within a few hours, or days, or weeks), to *learn* how to see through a loupe; in other words, to use the ophthalmoscope without any appreciable exertion of the accommodation. If some observers call this in doubt, their isolated experience cannot be allowed to weigh against the overwhelming testimony of others who find that in the repeated examination of the same eye they have invariably to resort to the same glass for correction. A good revolving ophthalmoscope facilitates the examination materially, and I believe the chief cause of dissent to be the imperfect state of most of the instruments still in use at the present time.

B. There is further always this little drawback attaching to the direct method, that we do not adjust for the fovea centralis of the patient's eye, because it is optically too little marked, and also because its being made the point of fixation involves an undue contraction of the pupil. In the method of Coccia (Stimmell) this fault is pretty well guarded against. A convex lens covered with a metal grate is in front of the flame; the incident pencils of luminous rays are rendered parallel, and are by a small plane mirror reflected into the eye to be examined, which, in its turn, is corrected for parallel rays by a glass held as straight as possible in front of it. The general practice, however, is to put up with the flame of an ordinary lamp, and to accommodate for the lateral edge of the papilla, or for one of the fine blood-vessels coursing from the optic disc towards the macula lutea, the bright central lines of which are very readily perceived, or for the ring of connective tissue at the lateral edge of the papilla, or the granular aspect of the fundus (the retinal epithelium)

thereabouts. Now the lateral edge of the papilla is about 3 mm. or 12 angular degrees distant from the fovea centralis, and still it is the refraction of the latter (*i.e.*, its relative position to the principal focal point of the quiescent dioptric system of the eye) which we are seeking to determine. Experience shows that in cases of emmetropia and hypermetropia the error is but very slight, as is confirmed by the controlling trial of glasses for the correction of the atropinised eye (Mauthner, Schnabel, &c.), whereas in myopia, even of moderate degree, the difference is sometimes found to amount to -1 D ($= -\frac{1}{36}$ inch). In cases of ametropia, however, which call for ± 10 or 12 D , or upwards, as *e.g.* in aphakia, the error (0.5 D to 1 D) is utterly insignificant. It is not the absolute, but the relative amount of the latter which requires to be weighed; nor must we lose sight of the fact that, in many disquisitions on physiological optics, the best authors, physicists as well as physiologists, look upon errors, amounting to from 5 to 10 per cent. of the quantity sought, as matters of course. It has no sense, at the present time in our examination of patients, to aim at any greater accuracy. If approximately correcting glasses are supplied in a case of $H\frac{1}{3}$ (12 D), a slight forward or backward movement imparted to the spectacle-frame suffices to alter the strength of the glass by more than $\pm 1\text{ D}$. It is, therefore, quite unnecessary, so far as the stronger glasses of the refraction ophthalmoscope are concerned, to retain the interval of 0.5 D . Beyond ± 10 or 12 D , it is better for the rapid and sure determination of the proper glass to have the interval $= 2\text{ D}$.

C. In the method here advocated we estimate, it is true, the refraction of the eye for red light, and not for that of greatest brightness, with which, however, ordinary vision is concerned. Badal* makes the difference to be equal to

* Bulletin Mensuel, Avril, 1877. Paris, De la Haye. Such a sentence as this, "Puisque la refrangibilité du rouge n'est pas la même que celle de la lumière blanche composée," should not be allowed to see the light after Newton's discoveries.

0.75 D, but a simple calculation shows it to be no more than 0.25 D, and hence entirely insignificant.

D. In adjusting for the fine median blood-vessels, we determine in reality the refraction of the vascular instead of that of the sentient layer of the retina, the distance between the two being a small fraction of 1 mm. The thickness of the retina between the papilla and fovea is about 0.3 mm. Hence the possible error is certainly less than 0.15 mm., that is, under + 0.5 D, seeing that in the schematic emmetropic eye a distance in depth 0.3 mm. corresponds to a difference of refraction equal to 1 D.

All these trifling errors can only interest us in connection with the question whether such slight deviations from the emmetropic condition are capable of being diagnosed. In cases of pronounced ametropia, they may be left out of account entirely. The conclusion is, then, that in the direct method, pure and simple, we have a secure means of establishing the presence even of an ametropia of $\pm 0.75 (\frac{1}{48}$ inch), that is, one corresponding to the weakest glasses of the ordinary trial cases. And this quite accords with our experience that the objective method of determining the refraction for the most part yields more exact results than the subjective, in which we depend solely on the statement of the patient. The former frequently discloses small differences between the two eyes, of which he had not himself become aware in the selection of glasses.

It is necessary, too, to insist that the former is the far more expeditious of the two, and that it is also of much more extended scope, being equally applicable in the cases of children and illiterates, of simulation and amblyopia; and, finally, that it enables the analysis of astigmatism, qualitative as well as quantitative, to be made in the most reliable manner. Yet, for all that, we cannot dispense with the trial case. It is always advisable, wherever it can be done, to superadd the subjective examination. In the search after truth, the methods of inquiry ought to be multiplied rather than restricted.

FOREIGN BODY (PIECE OF STEEL) EMBEDDED CLOSE TO
OPTIC DISC, WITH RETENTION OF PERFECT SIGHT.

By SIMEON SNELL,

Ophthalmic Surgeon to the Sheffield General Infirmary.

George H. Driver, æt. 19, was striking a chisel with a hammer on October 23rd, 1877, when a portion of steel flew off the chisel and hit his right eye. On the 26th, three days later, he came to the Sheffield Infirmary. There was then, beyond a slightly increased vascularity of conjunctiva, no outward appearance of inflammation of eyeball. He had suffered no pain. The pupil dilated fully under atropine. Examined with the ophthalmoscope the media were clear, and allowed a good view of the fundus oculi. Situated a short distance to the outer and lower side (inverted image) of the optic disc and lying on an artery and vein, was a black looking body surrounded with hæmorrhage, a little of which was also between it and the papilla.

There was otherwise nothing abnormal to note.

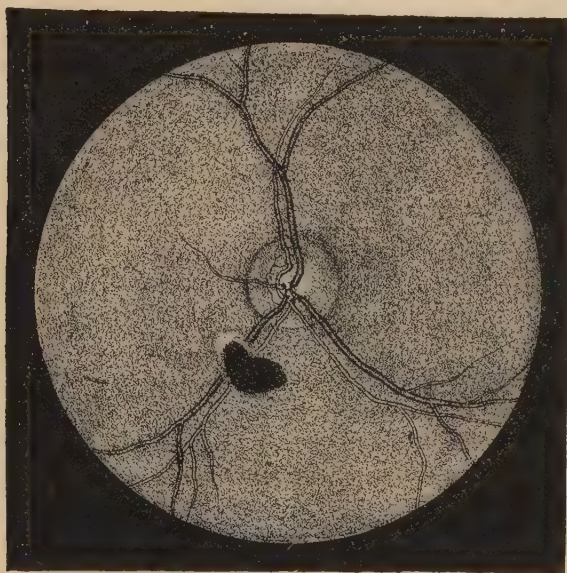
The black looking body, with its metallic lustre, was plainly the piece of steel which had struck his eye, but at what point it had penetrated was not so evident. Examination at first by myself as well as the house surgeons failed to detect any external wound, and it was only by very careful inspection with a magnifying glass that at last a tiny, very faint, horizontal wound, quite closed, was discovered at the inner side, in the sclerotic, a short distance from its corneal junction. His vision was not accurately tested at this time, but it was by no means very defective, and he could see the time by a watch readily enough.

The freedom from inflammatory action in the eye, as well as the condition of vision, rendered any attempt at the removal of the foreign body unjustifiable, which to say the least from its situation embedded in the tunics and its proximity to the "disc" would have been difficult and hazardous. It was decided, therefore, to admit him into the infirmary, and keep a careful watch over him. Except the use of atropine for the first few days, no treatment was adopted. A day or two after admission it was ascertained he could read Jaeger 10.

November 16th.—Made an out-patient to-day.

November 23rd.—Can now read number one of Jaeger's types fluently.

He has attended at intervals since and his sight still remains perfect. At the time of my writing this he says the sight of the eye is equally good as the other. The hæmorrhage has long since disappeared, and the foreign body is seen lying on the artery and vein, with a little white patch of atrophy upon it.



Foreign bodies lodged in the eye, it is well known to those who see much of ophthalmic practice, are among the most perilous of accidents that can happen to that organ. Destruction of sight, with inflammation or frequently supuration of the globe are too commonly the result of their presence, to say nothing of the danger the other eye is placed in by them. Occasionally they may become encapsuled, the inflammation subside, and good vision result. Mr. Soelberg Wells relates a remarkable instance of this

sort. I am, however, not able to find a case on record quite similar to the one here mentioned.

The chief points of interest appear to me to be :—

1. The quiet condition in which the eye remained from the first.

2. The freedom from haziness of the vitreous through which the foreign body must have passed.

3. The distinctness with which the piece can be seen.

4. The retention of such perfect sight, rather more than five months having now elapsed since the time of the injury.

In connection with this case I would relate another in which a piece of steel becoming encapsuled in an eye remained there for 29 years without producing sympathetic ophthalmia in its fellow, but for the last 9 years the eye was at intervals the seat of most excruciating pain.

William Wortley, æt. 50, came under observation in April 1875. He stated that 29 years previously whilst “lining” a pair of shears, a portion of the “steeling” flew off and struck the white of the right eye. The piece was about $\frac{3}{8}$ of an inch long, and half of it was embedded in the eye. He applied to a surgeon, who withdrew it. After about two months’ suffering the eye became quiet, but a glimmer of sight remained for two years. For 20 years he had no pain or uneasiness in the eye, but for the last 9 years had had attacks of most excruciating pain over forehead and temple, and in the eye itself. The attacks were attended with an inflamed condition of eye, and lasted for weeks together, preventing him following his employment and each time becoming worse.

When I saw him, the conjunctiva was injected, the cornea was bright, and anterior chamber clear, but a portion of iris was wanting at its lower and outer part—just as if an iridectomy had been performed; there was a scar, also, just beyond the sclero-corneal junction. Tension was normal. The eye could not be illuminated with the ophthalmoscope. There was no sight, not even perception of light.

Beyond a feeling of weakness, the left eye was normal.

As it was thought probable that a portion of the steel might

have remained in the eye, enucleation was advised. He readily consented to lose such a painful organ, and it was accordingly removed, under chloroform.

On examination, the vitreous was found fluid, the choroid atrophied at parts, and a piece of steel about $\frac{1}{8}$ of an inch in length embedded in the ciliary processes. The lens was opaque and black looking.

OPERATIONS FOR SENILE CATARACT AT THE MOORFIELDS HOSPITAL DURING ELEVEN MONTHS.

By A. STANFORD MORTON, M.B.,

Assistant Surgeon to the South London Ophthalmic Hospital.

THE following is a condensed report of 146 cases of senile cataract operated on by the various surgeons of the hospital from December 1st, 1875, to October 31st, 1876, and which came under my care as senior house surgeon during that period. It is completed by continued observation of many of the cases up to August of the present year, and comprises *all* the cases of *senile* cataract (but *senile* cataract *only*) operated on at that time.

After-treatment.—A general outline of the after-treatment may be given in few words. As soon as the operation was completed the lids of each eye were fastened by a very narrow vertical strip of plaister, to prevent involuntary opening of the eyes during recovery from the anæsthetic, then a piece of lint, on which was placed a layer of cotton wool for each eye, and over all the bandage. The eyes were dressed each morning and evening after the operation, being gently bathed with tepid water and the lids oiled with a soft brush to prevent the dressing sticking to them. The patients were kept in bed till the third day, and the lids never opened till the fourth or fifth day after the operation, unless there were indications of mischief. About the end of a week they were handed over to the nurse to dress, and in about nine or ten days were allowed to have their eyes open, but very carefully shaded. Of course, if at any time there was anything amiss, treatment was adopted according to circumstances, but it is not necessary here to enter upon that subject.

The *average duration* of stay in hospital after operation was within a fraction of being 24 days. The *ages* of the patients ranged from 38 to 87.

Anæsthetics were administered for 128 of the operations, chloroform being given in 20, ether in 33, and a combination of chloroform and ether in 75. In 82 of these, there was more or less vomiting or retching after the operation, but no harm appeared to accrue from this accident in any of the cases except one, where there was protrusion of the retina through the wound, with hæmorrhage, shortly after the operation, but as vitreous had protruded before the eye was tied up, it is possible that this was one of those cases of intraocular hæmorrhage after extraction which sometimes occur when there has not been any straining.

Method of Operating.—The operations were performed by 5 different methods, viz.: Modified Graefe 105, Brussels 17, Streatfeild 17, Scoop 16, and Flap 1. With regard to the “modified Graefe,” as performed at Moorfields, the following is a very brief description: the essentials are, 1st. That a Graefe linear knife be employed; 2nd. That the section be made upwards; 3rd. That the section be wholly in the corneal tissue; and 4th. That there be an iridectomy. The details vary slightly, according to the opinion of the operator or the nature of the case, that is to say, the section may be made at the extreme periphery of, or more anterior in, the cornea; the base of the flap may be higher or lower, according to the size of cornea or nature of cataract; and lastly, there are small differences in the method of excising the iris, lacerating the capsule, and removing the lens, not any of them sufficient to merit giving a different name to the operation. In performing the Brussels operation, the puncture and counter-puncture were made with a Graefe’s linear knife at the periphery of the cornea on a level with the upper border of the undilated pupil; the edge of the knife being then turned forwards, the operator cut directly out through the cornea at a point midway between the upper margin of the pupil and periphery of the iris, the capsule being lacerated and the lens removed without an iridectomy. A

solution of sulphate of eserine (four grains to the ounce) was usually instilled immediately to prevent prolapse of the iris. A description of Streatfeild's method will be found in the "Report of the 4th International Ophthalmological Congress," p. 138.

Complications.—The *scoop* had to be employed to complete 4 of the extractions. *Escape of vitreous* occurred during 5 of the operations. *Iritis* supervened altogether in 49 cases; of these 38 led to no more serious result than a certain amount of occlusion of pupil, drawing up of pupillary margin towards cicatrix or adhesion of iris to the scar (the former accident occurring in 8 of the Graefe extractions and the latter in 7 of the Brussels operations). The remaining 11 ended in total loss of the eye operated upon, 8 of these being from panophthalmitis consequent on iritis and suppuration of cornea commencing within a day or two of the operation, and 3 were excised, after some months, on account of long-continued irritation, pain, and increased tension. In addition to the above, there was one eye lost by protrusion of vitreous and retina from retching after the anæsthetic, and another from the patient knocking it during recovery, thus making a total of 13 *eyes entirely destroyed*.

Both eyes operated on at the same time.—In 7 individuals the two eyes were operated upon at once. In one case both were done by "Graefe's modified," while in another both were done by the "Brussels," but the remaining 5 individuals each had the one eye operated on by the "modified Graefe" and the other by the "Brussels" method. The results of these cases were as follows:—In one individual where each eye had been done by a different method, that one on which the "modified Graefe" was performed, had to be excised on account of irritation and pain from iritis and subsequent needling, while in another case where both methods were employed, that eye done by the "Brussels" retained the barest perception of light. The other cases did fairly well, and the one in which the "modified

Graefe" was performed on both eyes recovered with V. = $\frac{2}{20}$ and J. 1 in each eye.

Secondary operations.—For drawn-up pupil, membrane in pupillary area, &c., there were 30 secondary operations, viz., iridotomy 8, needle 20, and iridectomy 2.

Visions.—The vision of most of the patients is that which was taken at date of discharge, but several were taken some time afterwards and many after a secondary operation. In addition to the usual spherical cataract glasses, *cylinders* were requisite in 13 cases. Of the 146 cases, 13 were totally lost, and 6 not having had their sight tested at discharge, on account of irritability of eye, &c., never returned. The vision of the remaining 127 is as follows:—

Vision.	G.	B.	Sd.	Sp.	F.	Total.
$\frac{2}{20}$ and J. 1.....	12	3	2	—	—	17
$\frac{3}{30}$ and J. 1.....	12	2	1	—	—	15
$\frac{4}{40}$ J. 1 to J. 4	7	2	3	1	—	13
$\frac{5}{50}$ J. 1 to J. 6	11	—	—	4	—	15
$\frac{6}{60}$ J. 2 to J. 16.....	10	—	4	—	—	14
$\frac{7}{70}$ J. 4 to J. 16	8	2	3	1	—	14
$\frac{8}{80}$ J. 4 to J. 16	11	2	2	—	—	15
Less than $\frac{20}{200}$	16	5	2	—	1	24
Entirely lost	12	1	—	—	—	13
V. not taken	6	—	—	—	—	6
						146

NOTE.—G. = modified Graefe, B. = Brussels, Sd. = Streatfeild's, Sp. = Scoop, and F = Flap.

These visions are inclusive of those cases on which a secondary operation had been performed, viz., after Graefe extraction 25, after Brussels 2, and after Streatfeild's 3. The above results would have been much more favourable had all the cases which were discharged with capsule, &c., in the pupil returned for the secondary operation.

Two cases appear to be worth recording *in extenso*:—

CASE I was a healthy woman, æt. 57, on whom a Graefe extraction was performed in the L. eye on March 27th, 1876,

and, though a small piece of iris was left entangled in the corner of the incision, recovered without a bad symptom, having at discharge on April 18th V. = $\frac{2}{7}\%$ and J. 10. On July 27th she returned to the hospital stating that all had gone on well for the 3 weeks after going home, when she "took cold" in her eye. On examination I found the one which had been operated on retained no perception of light, the tension being + 1, while in the R. eye there was bare perception of light and tension + 2, in fact it presented all the appearance of an eye with sympathetic iritis, and was probably caused by the irritation produced in the eye from the portion of iris which, as mentioned above, had healed in the cicatrix. The R. eye was so painful that it was excised, and after suffering pain in the L. till April, 1877, it was excised also. This case is given to show the necessity of removing all portions of iris from the cicatrix during the operation; for, though it is by far the most serious one of the kind which I remember, yet there is often produced long-continued, troublesome irritation from neglecting this precaution.

CASE II is also one of sympathetic inflammation, though of a different nature. The patient was a woman, æt. 58, in very fair health. On April 25th, 1876, Graefe's operation was performed on her R. eye, and it was progressing most favourably when, 10 days afterwards, the same operation was performed on the L., this was immediately followed by pain, œdema, muco-purulent discharge, and partial suppuration of the cornea; these symptoms, however, passed off, leaving her a pupil blocked with lymph and bare perception of light at discharge on June 12th, at which date the V. in the R. was $\frac{2}{7}\%$ and J. 2. She returned on 11th with bare perception of light and such intense pain in the L. that it was excised, the vision in the R. having at the same time deteriorated to less than $\frac{2}{200}\%$. On September 1st she again returned with great pain in the R., T + 1, no anterior chamber, the iris in apposition with the cornea, pupil blocked with lymph, and barely counting fingers at 6 inches.

A FURTHER CONTRIBUTION TO THE PATHOLOGY OF INCREASED TENSION.

By W. A. BRAILEY, M.D., *Curator of the Museum.*

THE conclusions arrived at in this paper are based on the examination of all the pathological specimens contained in the Microscopical Collection of the Moorfields Hospital Museum, in which the tension of the eye was accurately determined and recorded at the time of excision.

It comprises 149 cases, among which are included a majority of the cases upon which the preceding paper of the author was founded (R. L. O. H. Reports, vol. ix, part 2). But to these many more have been added, especially within the last year. These most recent cases are the most valuable, because many points, which have since the date of the last paper suggested themselves both as to history and morbid appearances, have been carefully observed. Thus it comes about that, whereas in each of the earlier cases specimens are preserved, showing (i) the Ciliary region by meridional sections, usually both of its upper and lower part, (ii) the Optic Disc with the adjacent Choroid and Retina, (iii) the Choroid and Retina of some part of the periphery of the eye, the more recent cases show not only similar specimens of the Ciliary Region and Optic Disc, but also vertical sections through the Sclerotic, Choroid, and Retina near the periphery of the globe, cut at such a point as to contain also sections through the Long Ciliary nerve and artery in their course forwards. In many of these cases fine sections are also made through the Ciliary region in an equatorial direction, so as to show more minutely its condition, especially with relation to its pigment, epithelium layer, and efferent veins.‡

Besides the morbid anatomical conditions already recorded, there is found in pure Glaucoma cases, almost

without exception, a most important change in some or all of the bloodvessels of the interior of the eye.

This consists in a great enlargement of their calibre, consequent on their dilatation. It is accompanied in the majority of cases by a thinning of the walls, which attains sometimes to an extraordinary degree.

This condition is especially seen in, and indeed seems to be almost confined to the vessels supplying the Ciliary region; and it is much more conspicuous in the arteries than in the veins.

In order to study it, I have taken in all cases the measurements of the *Circulus Arteriosus Iridis Major*, as seen in meridional sections through (i) the upper, (ii) the lower part of the anterior segment of the globe, because this artery seems to be in healthy eyes one of the most constant, in position and size, of the vessels of the Ciliary region. To briefly show that such a change exists, I have computed the average internal diameter and wall thickness of this vessel in the 85 eyes whose tension was increased at excision, two specimens being taken in nearly every case from each eye; one from the upper and one from the lower part of the Ciliary circle. In the same way I have treated (i) 8 normal eyes prepared under precisely similar circumstances, in order to serve as a standard of comparison; (ii) 22 diseased eyes, with normal tension; and (iii) 34 diseased eyes whose tension was diminished.

A comparison shows a marked difference in these respects between increased, diminished, and normal tension, thus:—

Eight normal; av. diam. of art., $\cdot 0253$ mm.; av. wall thickness, $\cdot 0073$ mm.; av. thickness of cil. muscle, $\cdot 685$ mm.

Diseased eyes, with normal T at excision; art. $0\cdot 274$ mm.; wall, $\cdot 0085$ mm.; muscle, $\cdot 57$ mm.

Diseased with $-T$; art. $\cdot 0214$ mm.; wall, $\cdot 0082$ mm.; muscle, $\cdot 675$ mm.

Diseased eyes with $+T$; art. $\cdot 0405$ mm.; wall, $\cdot 0048$ mm.; muscle, $\cdot 411$ mm.

This difference would be much more strikingly expressed in figures if the sectional area of the artery were computed instead of the diameter only.

When, however, the cases with + T are further examined, it is found that they can be divided clinically into several groups, in some of which the arterial changes especially are much more striking than in others.

Taking, in the first place, the 27 cases in which the Glaucoma appears from its symptoms and history to be a primary disease, that is to say, Glaucoma uncomplicated by any previously existing morbid condition, or any markedly recognizable accompanying inflammatory lesion, I find in them the average diameter of the Circulus is .04686 mm., and its average wall thickness, .003185 mm. They thus exhibit a still larger excess in diameter and a greater deficiency in wall thickness, as compared with healthy eyes or diseased eyes with T either normal or minus.

Examining still more fully this group of 27 cases of pure Glaucoma, I find this enlarged and thinned condition of the Circulus to be totally unrecognizable in one case (No. 303, cited below), and in nine more it is visible at one part only of the Ciliary circle, being absent from the upper part in seven of these cases, and from the lower part in the remaining two. Even the total exception will be seen hereafter to have the Long Internal Ciliary Artery dilated and thinned, in its course forwards, to a very extraordinary extent: thus, though one more of the cases shows but moderate dilatation and thinning either in the upper or lower part of the Ciliary region, it is clear that this condition is a very constant one in uncomplicated Glaucoma.

I may here remind my readers that this arterial ring forms an anastomosing circle in the anterior part of the Ciliary body near the base of the Iris. It is made partly by the Anterior Ciliary Arteries which issue from the Recti Muscles, and perforate the Sclerotic in front of the insertions of these, but principally by the two Long Ciliary Arteries which also form further back in the muscle a second

anastomosing circle, less constant, however, in position and size. From the *Circulus Major*, branches are given off to supply the Iris and Ciliary Muscle. The venous blood escapes principally through veins running from the Ciliary body into the veins of the anterior part of the Choroid. It finally escapes from the globe in company with the venous blood of the Choroid by the *Venæ Vorticosæ*.

That this pathological condition is sometimes found at one part only of the Ciliary circle appears so extraordinary, that I have of late examined the Long Ciliary Arteries in their course forwards through the Sclerotic, with a view of determining whether they are also involved in it. I regret that it is only within the last year that it has occurred to me to do this, so that I have specimens from comparatively few cases. Moreover, this examination is attended with some difficulty; for unless the sections happen to show the artery as it bores its way obliquely through the Sclerotic, it is difficult to recognize it with absolute certainty; and even when it is recognizable in its scleral tunnel, its non-enlargement may be attributable to the immediately surrounding Sclerotic yielding or being absorbed very gradually.

Such measurements of the Long External Ciliary Artery show that its average scarcely exceeds either the average measurement in healthy eyes or in diseased eyes with normal T, and the same, generally speaking, is the case in regard to the Long Internal Ciliary.

For although about half the cases present some enlargement and some thinning, yet the degree of this, with a few striking exceptions (see No. 303, page 395), is not so great as that seen in the *Circulus Major*.

In the remaining cases the average is even below the normal, perhaps owing to increased pressure of the Sclerotic on the artery in its oblique course through it. Such pressure would have a contrary effect on arteries perforating vertically.

In 12 cases of this group (Group I) the average measurements are:—Long Internal Ciliary, diam., .0478; wall

thickness, $\cdot 0132$ mm. Long External Ciliary, diam., $\cdot 045$; wall thickness, $\cdot 0147$ mm. In two healthy eyes the measurements are:—Internal Ciliary, diam., $\cdot 047$ mm.; wall thickness, $\cdot 017$ mm. External Ciliary, diam., $\cdot 035$ mm.; wall thickness, $\cdot 017$ mm.

The enlargement of the arteries appears to be a primary condition, preceding in time even the atrophy of the Ciliary Muscle, for it is found in some cases of Glaucoma of short duration, accompanying a fairly developed muscle. (See Cases Nos. 101, page 396, and 177, page 394.)

It might be thought to depend on an obstruction to the exit of blood from the eye through the choroidal veins, due either to pressure on them generally, or to compression of the *Venæ Vorticosæ* during their passage through the Sclera. But strongly in opposition to this idea is the fact, that this enlargement is limited to one region in so many cases, and when we come to examine the next group of cases, we shall find some striking instances of this.

A comparison of the arterial measurements previously recorded shows, in addition to the enlargement, a very considerable diminution in the wall thickness.

This is important, because in long-continued enlargement of an artery consequent on increased nutritive activity of the parts supplied by it—as for example in inflammation or tumour growths—the wall thickness would be gradually increased in proportion to the increased calibre.

But in Glaucoma, though a certain amount of thinning is due, without doubt, to simple enlargement in capacity, yet beyond this the walls themselves atrophy. This is proved by a comparison of the most recently affected eyes with those whose disease is of long duration. In some, indeed, the wall thickness can scarcely be measured, and no structure can be made out microscopically beyond a basement membrane and a few nuclei.

This condition is something special to Glaucoma, for it is not found in eyes with long standing disease accompanied by normal or minus T (see Groups VI and VII),

unless there has been previous Glaucoma, as evidenced by the history, or by the state of the Optic Disc and Iris.

An examination of 4 eyes, formerly glaucomatous, though their T has now fallen to normal or minus, reveals this thinning in 2, though the arteries are now of normal size, their average diameter being $\cdot 03$ mm., and their wall thickness $\cdot 0025$ mm. In the third case the arteries are extremely small, and the walls in comparison fairly thick. In all three the muscle is extremely atrophied, and the Iris periphery adherent to the Cornea. In the fourth case there is recorded only a short attack of + Tension, accompanied by severe pain. Here the artery is of normal size and wall thickness at the time of excision, and the Ciliary muscle is well developed.

I have no observations of any value to record as to the condition of the Anterior Ciliary Arteries in their passage through the Sclera, but it is a matter of clinical observation that these are in some cases enlarged in their course on the exterior of the eyeball. I should infer, therefore, that the Long Ciliaries may be affected also exterior to the globe. Naturally the enlargement is not restricted to the Circulus Major, but often the whole anterior part of the Ciliary muscle is rendered completely cavernous by dilated blood spaces, which appear to be principally arterial. In my former contribution I mentioned these blood spaces as existing in the Ciliary region, but I incorrectly supposed them to be enlarged veins.

As far as I have examined the efferent veins of the Ciliary region, my impression is that they present no enlargement at all corresponding to that of the arteries, but further inquiries in this direction are needed.

I can say nothing as yet about the Short Ciliary Arteries, for their investigation is attended with difficulty on account of their number, small size, and mode of perforating the Sclera. I have no measurements either of the Venæ Vorticossæ or the Retinal vessels.

The ophthalmoscope shows that the Retinal arteries are

early diminished in size, and that this is ultimately the case with the veins also. There is sometimes an aneurysmal condition of the smaller retinal vessels. Hæmorrhages into the Vitreous or Retinal substance are not uncommon. I have no reason to think any of these changes to be in any degree the cause of an increased tension.

In conjunction with the vessels there may appropriately be discussed here another pathological condition, found sometimes in Glaucoma, and, as far as I know, peculiar to it, which is, without doubt, consequent on the implication of the Long Ciliary Arteries in the above-described glaucomatous changes.

This consists in a thinning of the Sclerotic in the course of the External and Internal Long Ciliary Arteries and Nerves. It is usually seen as a wide bluish-black streak extending forwards in the Sclerotic from their point of entrance on either side of the Optic Disc up to and sometimes beyond the equator. Sometimes the bluish area is so extensive and so thin that it makes an actual staphylomatous bulging.

This condition was present on the inner side in 7 out of 12 cases of Group I, and microscopical sections show in 6 out of the 7 an enlargement and thinning of the Ciliary Artery corresponding to it. In the 7th the condition of the artery remained undetermined from imperfect observation. The average diameter of the Long Internal Ciliary in these 6 cases is $\cdot 064$ mm., and its average wall thickness $\cdot 01$ mm., as opposed to $\cdot 032$ mm. diameter and $\cdot 015$ mm. wall thickness in the five eyes not staphylomatous in this place. The average normal measurements are $\cdot 047$ mm. and $\cdot 017$ mm. respectively.

Staphylomata are less frequent on the outer side, but where they occur they are accompanied by a corresponding change in the artery.

In the centre of the thinning is found the enlarged artery, and in the more marked cases the Sclerotic there is loose in texture; its fibres are attenuated and irregularly

disposed, and among them are a few scattered nuclei. Where there are actual bulgings the structure of the Long Ciliary nerves is almost totally destroyed.

The thinning begins where the artery approaches the inner scleral surface, and in this position there may be only an abnormally deep groove for its reception, whereas further back the Sclerotic is scarcely affected.

With one doubtful exception, no other Scleral Staphylomata are visible in any cases of this group, nor any Ciliary Staphylomata, whether corneal or scleral. I am of opinion that local scleral thinnings other than in the course of the Long Ciliary Arteries are only found where there has been Choroiditis or Cyclitis, and that they are absent, therefore, where Glaucoma is a primary disease.

Leaving the arteries and passing to the condition of the Ciliary muscle; the measurements already given show that the average muscular thickness of all the cases with + T is less than in diseased eyes with T normal or minus, and also less than in healthy eyes.

This is more markedly seen if we consider only the group of pure Glaucoma cases (Group I). In these the average muscular thickness is .35 mm., the greatest bulk being, on the average of the two sections, .5 mm., and the least .2 mm. The additional cases now examined confirm generally what I said in my former paper, except that I am now satisfied that the extent of the atrophy depends on the duration as well as on the acuteness of the disease.

This atrophy is not preceded by any considerable increase in the nuclei of the muscle. In one case of 10 weeks' duration quoted below (No. 177), the first change appears to be that the muscular fibres have their structure indistinct, with, possibly, a slight excess of nuclei round them. But far more frequently the specimens show even fewer nuclei than usual. And, just as in the Iris, the cases with greatest nuclear increase are far surpassed by many with T normal or minus.

That the atrophic change is not due to the pressure of

the increased contents of the globe is evident from the fact that in two of the cases of uncomplicated Glaucoma the atrophy is confined to one part of the Ciliary circle, the lower in each, passing upwards from which the muscle gradually improves till the opposite upper region, where it is nearly normal. But it appears to be partly wanting, to say the very least, in the cases of shortest standing; for instance, in one with a history of 10 weeks, the muscle is .45 mm. thick, and its texture is good; and in another of 5 months' duration it has moderate texture, though it is only .38 mm. thick. Therefore I judge that it occurs second in point of time to the arterial changes.

It is interesting to observe that the muscle undergoes the earliest and greatest atrophy at its antero-internal part, the region where an enlarged artery (the *Circulus Major*) is most commonly found.

This gives the idea that the atrophy may be the direct consequence of the vascular change. That dilatation occurs in several cases, especially in the Group next to be described, without atrophy, is not inconsistent with this explanation, if we suppose it to have recently come on.

But, after all, the most reasonable supposition seems to be that they are due to a common nervous influence. Thus they will start simultaneously, but one will be obvious far more quickly than the other.

This is supported by one case (No. 303, see page 395), which shows no dilatation of the *Circulus Major*, either above or below, notwithstanding that the Long Internal Ciliary is remarkably enlarged and thinned. In it the muscular structure, though averaging .42 mm., is decidedly thin, both in the upper and lower ciliary region. I must note, however, in view of what will be said hereafter on the subject of Iridectomy, that a good Iridectomy upwards had been done two weeks before excision, though without effect on the Tension.

I come to the conclusion, therefore, that though the muscular changes are very constant and very marked, yet

that they are less frequent than the arterial dilatation, even in such long standing cases as require to be excised, and that, had I an opportunity of examining cases at an earlier period of the disease, this muscular atrophy would be met with in various stages of development. Apropos of this, will be noted the comparatively small bulk of the muscle, though its structure is good, in the cases of short duration above referred to.

Some further evidence on these important changes, both muscular and arterial, will be offered when we come to consider the other groups of cases with + T, especially those in which eyes containing tumours have become glaucomatous (Group III), and those where some slight accident has been the starting point of the Glaucoma (see Group II).

An analysis of all the cases with increased tension (Groups I—V) shows that the periphery of the Iris is very commonly applied to the adjacent corneal margin. In fact only 9 out of the entire 86 have the Iris periphery free both above and below, and, therefore, presumably all round. But there are also, including the iridectomized eyes in which + T has returned, 11 cases in which the Iris on one or other side is perfectly free, making 11 partial and 9 perfect exceptions to the general rule that the Iris is applied to the periphery of the Cornea.

Of the 27 cases of Group I, the Iris is free both above and below in only 2 cases, and free on one side in 1 case more. This application is then a very constant condition, much as the changes in the muscle and arteries.

But an examination of Group VI (with Tn) and Group VII (with - T) shows that this condition, though rarer than in Group I, is still frequently met with. For in Group VI the Iris is adherent on both sides in 5 cases out of 21, and on one side only in 2 more. And in Group VII on both sides in 12 out of 34 cases, and on one side only in 4 more. I have a case with partial peripheral adhesion, from a very long standing perforating wound, in which the

Tension has never been increased. And in cases of old Glaucoma with falling Tension the adhesion must still remain. Clinical observation of Glaucoma eyes shows that at an early period of the disease the pupil is sometimes mobile and the Anterior Chamber exists all over. Moreover in Group I there are 2 cases (see No. 177) in which the Iris is merely applied to the corneal margin and not adherent. These constitute strong reasons for considering this adhesion secondary to the +T. It may be a cause of maintaining it; but any influence it exerts in this direction will be better considered together with the cases in which the pupil is excluded. The applied base of the Iris presents in a majority of the cases of pure Glaucoma some slight inflammatory appearances. An excess of nuclei is seen in its structure, and usually also on its anterior surface, or between it and the Cornea. It is probably on account of this pre-existing inflammation that the adherent Iris base is frequently totally atrophied. The existence of past inflammatory changes is occasionally indicated by a rolling of the Iris on itself, either forwards so that the uveal pigment becomes visible on the anterior surface as a narrow zone extending from the pupillary edge, or as a broader one in more severe cases; or it may occasionally be rolled backwards, in which case no pigment zone is visible, but the Iris limb becomes shortened all the same.

But this Iritis is rarely extensive or acute. It often cannot be recognised during life. It is also wanting where the Iris is free, and therefore it is probably a consequence of its altered position.

Where Iritis is a cause of +T, as, for example, in Iritis Serosa, the Aqueous Humour is increased, whereas in this Group it is usually diminished. If further confirmation were needed as to the want of connection of the Tension in Group I with the Iritis, it would be found in the fact that the Iris has passed into an atrophic condition at the time of excision in many of these cases.

In close relation with the application or adhesion of

the periphery of the Iris to the corneal margin, comes the condition of Schlemm's Canal, which is important as having had attention directed to it by so distinguished an author as de Wecker, as furnishing a cause of increased Tension.

Taking, as before, microscopical sections from two regions of each of the eyes with +T, in which the observation is recorded, it is completely closed in 50 of them. But it is large in 19, of moderate size in 39, and barely visible in 61 others. It is only in 15 of these cases that closure occurs in both parts of the ciliary circle under observation.

Still this does not represent adequately the facts, for in every case in which the Iris periphery is in contact with the Cornea, though the canal of Schlemm exists, its use as a means of escape of fluid from the eye, if such be its function, is nullified. And indeed we find only 8 cases in which the Iris is free both above and below, and Schlemm's Canal open at the same time. Thus the condition of this canal seems to be of great importance. And its importance appears to be strengthened by a consideration of Group I, which contains only 2 cases with Iris free, and canal of Schlemm open at the same time in both parts of the ciliary region examined.

But an examination of the diseased eyes with normal T (Group VI), shows it to be obliterated both above and below in 5 cases out of 19. And Group VII(-T) contains 4 similar cases out of 34, as well as 6 in which the closure is on one side only.

Moreover, one of the cases of Group VII has the lower limb of the Iris so thickened by a sarcoma growth, that it extends almost close to the Cornea. The canal of Schlemm also is surrounded, and almost blocked by tumour cells. In this case, notwithstanding that any escape of fluid by this channel would be impeded, the Tension was slightly diminished.

None of the cases of Group I show any connection

between the condition of the Optic Disc, considered as a means of escape of fluid from the Eyeball, and the Tension.

The Pars Ciliaris Retinæ, and the Retina itself next demand a short notice. In Group I the Pars Ciliaris is either unaltered, or it has undergone a degenerative change.

In the great majority of its cases (about $\frac{4}{5}$ ths), there is a change in the columnar cell-like elements of this region, their internal ends are enlarged, and contain several large round nuclei, instead of the single small one usually found normally. Thus each element may become pear-shaped in outline. The fine fibrils emerging from between them can be more distinctly seen, as they lie between the narrow parts of the pear-shaped elements in the first part of their course towards the suspensory apparatus of the Lens. Generally also the fine lamina which covers the internal surface of the Pars Ciliaris can be seen to be raised up, except at the points where fibrils from the Pars Ciliaris enter it. Thus is formed a series of arches over the pear-shaped ends of the columnar elements of the Pars Ciliaris, as is seen in equatorial sections of this region.

But I find this condition to exist in some senile eyes that are not glaucomatous, and therefore, though I have not had full opportunity of investigating the matter, I think that these changes have nothing to do with originating increased tension.

The Retina shows a cystic condition of its most anterior Zone in about half the cases of Group I in which this region came under inspection. But I have also found it in many with normal T, and therefore I must exclude it also as a cause of Glaucoma.

I can detect in the rest of the Retina no changes in the structure of its elements that seem distinctive of, or even very common in, Glaucoma. The blood-vessels are always affected in the latter stages, as has been previously described.

In not one of the cases of Group I is there any inflammatory change in the Choroid, nor am I able to point out any distinct vascular change. Any variations in the Retinal pigment epithelial layer tend rather in the direction of atrophy, for in several instances it presents slight Colloidal changes. The pigment epithelium of the Zone just posterior to the Ora Serrata is often degenerated so as to constitute an irregular, darker coloured Zone, finely speckled with grey. I think that this appearance corresponds to where the Retina is in a cystic condition, and is that which has been described by Dr. Fuchs, as seen with the Ophthalmoscope. Microscopic examination, however, does not lead me to consider it to be due to present or past inflammatory changes.

The Epithelium covering the posterior part of the Ciliary processes is somewhat lighter in colour than usual, forming a series of brown radially-disposed stripes, alternating with the darker ciliary folds.

Some change is noted in the Vitreous in nearly every case of Group I. In most it had a slight yellowish tinge, while a few contained recent blood extravasations. In the cases of shortest standing, its consistency was not far from normal, though when cut into, more liquid than usual drained away from it. In those more advanced almost the whole Vitreous escaped as a syrupy, yellowish fluid. In several cases in which the Vitreous was somewhat more consistent it separated readily from the Retina at the posterior part of the Vitreous Chamber, to which it seems to have been only loosely applied.

In most cases the increase in volume to which the Tension is due is within the Vitreous Chamber, judging from the *post-mortem* position of the Retina, Lens, and Iris.

But there are several cases in which the Retina is detached into loose folds. In these the Vitreous and fluid must actually be diminished in bulk. This accumulation of Sub-Retinal fluid appears to bear no relation to the

enlargement of the Long Ciliaries. And even if we suppose that fluid has transuded from the dilated Ciliary Arteries into the meshes of the Vitreous, that will furnish no explanation why it should occasionally be found under the Retina.

The Sclerotic presents no special rigidity in Glaucoma. True it is often thick and firm in the cases of Group I, but not more often than is the case with normal eyes of the same refractive condition, and at the same period of life. With a rigid and unyielding Sclera, however, as in senile and hypermetropic eyes, the effects of +T become more rapidly expressed and more destructive.

The ocular conjunctiva is generally very thin in these cases. My observations as to other points, such as the condition of the Optic Nerve Sheath and the Optic Nerve itself, simply lead me to a negative conclusion as to any effects produced by them on the Tension.

Three interesting cases illustrative of Group I are here cited, one of old standing, one recent, and the third showing an exceptional condition of its Circulus Arteriosus.

No. 289. Rebecca D., æt. 66, widow. Two years ago, after severe mental shock, acute pain came in the top, back, and sides of her head; it extended to the left temple also, where it was accompanied by a continuous beating sensation. Six weeks later both extended from the temple into the left eye, and the sight was dim. A month later the sight became much worse after a violent vomiting, lasting an hour. Till a year ago she retained perception of light. She has worn glasses for reading for 41 years. The *right* has T 2, V. = $\frac{2.0}{2.00}$, h.m. = 2.5 D., with which V. = $\frac{2.0}{4.0}$ fairly. *Left* at excision: Globe small; pupil dilated and fixed. Lens cataractous; T 2. There is a broad black band, 3 mm. wide, along the course of the Long Internal Ciliary Artery, reaching as far forwards as the Rectus Internus insertion.

Equatorial Section.—Retina detached, except from O.D. and Ora Serrata, in loose folds. There are scarcely any traces of Vitreous in its cavity. Sections of the upper Ciliary region show the Iris somewhat inflamed, its base adherent to the Cornea, its pigment rolled forwards slightly into view by the contraction of

its anterior surface. The Canal of Schlemm is barely visible. The Ciliary muscle exhibits no excess of nuclei, but an extremely atrophic structure. Its thickness is $\cdot 34$ mm. The Circulus Arteriosus Major is enlarged, internal diam. = $\cdot 06$ mm.; its walls are thinned, $\cdot 003$ mm. The anterior part of the muscle is quite cavernous with dilated blood spaces. There is some degeneration of the Pars Ciliaris Retinæ. The anterior part of the Retina is a little cystic.

The Ciliary region below is much as above, except that the Iris apex is atrophied, and its base presents only a slight excess of nuclei.

Vertical section of the inner periphery shows the Choroid about normal, the Sclerotic thinned and bulged outwards, the Long Ciliary Artery somewhat enlarged; diam. = $\cdot 056$ mm.; walls rather thinned, = $\cdot 013$ mm. Nerve almost totally destroyed.

Similar sections of the outer periphery show much the same, but there is only slight dilatation of the Artery, and no Staphyloma.

The Optic Disc presents a moderately deep, universal cupping.

No. 177. Eliza R., æt. 79, widow. Ten weeks ago she could read ordinary print by the aid of +5 D. Then there came every now and then a slight beating and throbbing, like a gathering at the back of the *R.* eye and in the head. The eye was dim a little at these times, though generally she could see as well with it as before. Seven and a half weeks ago, after a violent attack of vomiting, acute pain seized her in the *R.* eye, the *R.* side of head as low as the Malar bone, and bridge of the nose. The skin of these regions was so tender that she could not bear to touch it. The pain continued growing worse and worse till excision. She last saw light three weeks before excision. The eye is much bloodshot. T 2.

The *left* has never pained or troubled her. V. = $\frac{20}{20}$; with +1 D. V. = $\frac{20}{40}$; with +6 D. she reads Jæger 1. Tension normal.

Equatorial section of *right*. Ch. and Ret. *in situ*. Vit. about normal in consistency; in it are one or two small hæmorrhages near the Retina. The Lens contains some peripheral, opaque striæ.

In Upper Ciliary region, muscular thickness $\cdot 5$ mm., antero-internal part well seen; fibres fairly bulky, though their structure is somewhat indistinct, and there may possibly be a slight excess

of nuclei around them. Circulus Major partly collapsed; diam. $\cdot 045$; walls, $\cdot 003$. Canal of Schlemm of moderate size. Pars Ciliaris shows degenerative changes. Adjacent Retina not cystic.

The Lower Ciliary region is much the same, but its Circulus is rather larger, = $\cdot 052$, and its walls thinner, $\cdot 002$ mm.

The Long Ciliary Arteries are not enlarged, and there is no Staphyloma corresponding to them.

The Optic Disc exhibits a universal shallow shelving cupping.

No. 303. William F., æt. 80. For seven years he has worn spectacles for reading. Twelve months ago both eyes came dim. Six months ago both watered constantly, and on shutting up the *Left*, he found that the *Right* had only perception of light. It has been painful six weeks. *Three weeks before excision* the *R.* still retained perception; its anterior chamber was deep; media hazy; T 3. *L.* field good. O.D. cupped and atrophied. T normal. Iridectomy upwards was done in each eye.

The *R.* remained tender and painful till its excision. Its anterior chamber re-formed slowly. Its tension returned. The T in the *Left* was relieved.

R. globe normal in size. There is a broad black streak along the course of the Long Internal Ciliary Artery, reaching as far forwards as the Rectus Internus insertion.

Equatorial Section.—Ret. and Ch., *in situ*; Vitreous, thin, syrupy, yellowish. There are many small hæmorrhages in it below.

Upper Ciliary Region. Iris limb entirely deficient above; there are no traces of any adhesion to the Cornea. Cil. Muscle: thickness, $\cdot 34$; structure thin; Circulus, normal in size = $\cdot 02$; wall thickness, $\cdot 0055$ mm. Canal of Schlemm just visible. There is some degeneration of Pars Ciliaris Retinæ as in the last case. Adjacent Retina not cystic.

Lower Ciliary Region, much as above, but Iris present with its periphery well away from the Cornea. There are large hæmorrhages between the posterior part of the Ciliary Muscle and the Sclerotic.

Vertical Section of Inner Periphery shows the Long Internal Ciliary vastly enlarged. Diam. = $\cdot 095$. Walls extremely thin, $\cdot 002$ mm. The fibres of the adjacent Sclerotic are a little thinned and separated, and there is much blood extravasated among them.

The Outer Periphery has its artery unaffected.

The Optic Disc shows a shallow shelving cup, extending right up to its margin.

GROUP II.

Standing next to the Uncomplicated Glaucoma Group are 13 cases, which in their pathological conditions are almost identical with pure Glaucoma. But these have had their plus Tension preceded by some injury or disease, which has probably been indirectly the starting point of the Glaucoma. In all of them, however, this condition has either long ceased to be active, or it is very slight, and of a nature not usually associated with plus Tension.

This group of cases is, however, in some respects even more important than Group I, because the previous morbid condition has not only rendered the duration of the disease more precisely determinable, but its existence has made both patient and surgeon agreeable to an earlier enucleation than would otherwise have been the case. Moreover, in several of them this exciting cause has been localized in one part of the Ciliary circle.

The average Ciliary muscular thickness in this Group is .423 mm.; the average diameter of the Circulus, .057 mm.; and its average wall thickness, .00342 mm. Thus in these respects the group resembles pure Glaucoma, though in size of the artery it actually exceeds it. But the muscle, on the other hand, is not quite so much atrophied, and this I connect with the rather shorter average duration of the cases. The same remark applies to the wall thickness, as both these atrophic changes appear to be gradual ones. But the arterial enlargement I consider to be a very rapidly occurring change, and in connection with this the condition of the artery in the following case belonging to this group may be noted.

No. 101. The patient was a man æt. 76. He has a myopia of 6 D. in his *Right* eye, together with some nuclear opacity of the Lens. In other respects it is normal. His statement shows

these conditions probably to have existed in the excised eye also.

Fourteen days before the excision a sharp fragment of iron struck him in the *Left* eye, perforating the Cornea close to its lower and inner margin, and at the same time dislocating the Lens, which remained hanging loosely from its upper and outer attachments. The Iris prolapsed a very little way into the perforation thus formed, and plugged it at its internal orifice. He was able to continue at his work. About a week later the eye began to be painful, and continued violently so till excision.

At the Ciliary region furthest removed from the wound, the Circulus Major has a diam. of $\cdot 055$ mm.; its walls are thin, though their limit is difficult to define. The Iris is not inflamed, and its periphery is widely removed from the Cornea. Other conditions are as on the side near the wound, where the Artery also presents just the same enlarged and thinned condition. The Ciliary muscle measures $\cdot 62$ mm., and is well developed. Its antero-internal part slopes backwards from its origin, so that the circular fibres are either partially deficient or else their direction is altered, making them inconspicuous. This may possibly have some connection with the myopia. There is scarcely a trace of inflammatory change anywhere, even in the Iris close to the prolapsed portion. The Canal of Schlemm is wide open, even where it is close to the prolapsed part of the Iris.

The Vitreous is a trifle fluid. The Lamina Cribrosa is slightly pushed back. The Long Ciliary Arteries were not examined. In all other respects the Eye was normal.

In conjunction with this may be cited another very important case in which the injury was confined to the upper and anterior region of the Sclera. The muscle in this neighbourhood was partially atrophied, and the Circulus Major dilated, whereas below both were of normal size.

No. 352. Mary W., æt. 38. Six months before excision a fragment of glass from the bursting of a mineral water bottle penetrated the Sclerotic of her *Left* eye, $\frac{1}{4}$ inch behind the upper corneal margin. No fragments remained in the eye. A suture was inserted, and she remained 3 weeks as in-patient at this hospital. At her discharge the fundus was not visible, but there was

red reflex as if from large blood clots near the wound. The T. was normal. Bare perception of light remained. There were no other symptoms.

For about 13 weeks the eye seemed no worse, but then it began to ache, and continued so till excision. This was advised on account of commencing irritability of *R.*

At excision the T was increased (T 1). There were some small posterior synechiæ at the lower pupillary border. The Anterior Chamber was of normal depth.

Microscopical Examination shows the measurements of the Upper Ciliary Region to be, muscle, .46; Circulus Major, diam., .038; walls, .012 mm.; and the Lower, muscle, .70; Circulus, diam., .017; walls, .008 mm. The muscle below is well developed throughout, whereas above it has its antero-internal part especially atrophied. There is scarcely any increase of nuclei whatever in the muscle at either region, Pars Ciliaris Retinæ or Iris, which last is free both above and below. The Canal of Schlemm is normal. On the internal scleral surface at the seat of the wound there is a prominent white cicatricial mass of tissue resembling the Sclerotic in structure, though its fibres are more irregularly disposed. Near it there are remains of a little Choroïdo-Retinitis.

The Long Ciliary Arteries are a little enlarged as they perforate the Sclerotic. Some specimens show a narrow empty space surrounding the artery and nerve. There are no local staphylomata anywhere. The Vitreous is fluid towards its posterior part. The Optic Disc presents a central pit, of the kind usually known as physiological, with very slight curving back of the Lamina Cribrosa.

I add accounts of two very interesting cases allied to these.

No. 777. Amelia D., æt. 50. Her *R.* eye, blind for at least 10 years with a cataract of unknown origin, is afflicted with a Glaucoma, probably of six weeks' duration. She noticed nothing wrong with it till she accidentally found 10 years ago that she could only just see light. Since then it never troubled her till she received a blow with a stick 6 weeks before excision. Then it inflamed, and for the last 6 weeks has been extremely painful.

At excision the pupil was widely dilated and eccentric, the

Lens cataractous, and the Tension increased (T 3). Microscopical sections show the Ciliary Muscle *above* to be extremely thin in texture, and to measure only $\cdot 33$ mm. in thickness, while *below* its texture is good, and its measurement $\cdot 7$ mm. The Arterial morbid changes exactly correspond with the muscular, for the Circulus of the *Upper* Ciliary region measures $\cdot 06$ mm., with wall thickness $\cdot 001$ mm., while *below* the corresponding Artery measures $\cdot 033$ mm., with walls $\cdot 005$ mm. thick. The Canal of Schlemm is only moderate sized *above*, though large *below*. The Iris is slightly inflamed both above and below, but while its periphery is firmly adherent above, it is unadherent though apparently applied to the Cornea below. The Optic Disc presents a moderately deep, though asymmetrical cup. There are no inflammatory changes other than those already mentioned. The Long Ciliaries were not examined.

Her other eye was presbyopic, but in other respects normal.

This case was figured in the author's previous paper (R. L. O. H. Reports, vol. ix, part 2). Then the Arterial changes were overlooked. The large blood spaces were generally incorrectly mentioned as veins.

No. 771. William F., æt. 67. 11 years before its excision a cataractous lens was extracted through the pupil of his *L.* eye by the old flap method. The case did well notwithstanding that the upper limb of the Iris remained adherent to the scar. After 9 years the sight began to fail, and pain came on in the eye, continuing till excision. Then the pupil was widely dilated, the upper limb of Iris very short and adherent to cornea. T was increased (T 1).

Examination after excision. Vitreous rather fluid; Ret. detached above between O. D. and equator; *Ciliary Region above*: muscle measures $\cdot 44$; texture thin; Circulus Major, $\cdot 043$; walls, $\cdot 002$ mm.; Iris adherent at base and at scar, intermediate part applied; Canal of Schlemm barely visible.

Below. Muscle, $\cdot 5$; texture good; Circulus, $\cdot 013$; walls, $\cdot 006$ mm.; Canal of Schlemm as above. Iris periphery is free from the Cornea; it contains a slight excess of nuclei.

The *Optic Disc* presents a shallow cup, which is not well seen in the sections. The Long Ciliary Arteries were not examined. No other important changes are visible anywhere.

Group II shows much the same alterations as in pure Glaucoma in the Vitreous, Pars Ciliaris Retinæ, Retina, &c. In other respects also the resemblance is close; the Iris is free in 7 specimens as compared with 19 in which its periphery is adherent to the Cornea. Schlemm's Canal, however, is only absent in one specimen, while it is small in 18 and of large size in 7. In 3 of the cases it exists in conjunction with a perfectly free Iris, both above and below.

Scleral Staphylomata are found along the course of a dilated Internal Long Ciliary Artery in 5 cases. One case has also a dilated Long External Ciliary, though without accompanying Staphyloma.

GROUP III.

This is a very interesting and important series of cases. In it are comprised those in which Intraocular Tumours are accompanied by increased Tension. It includes 5 cases, 3 of Sarcoma of Choroid and 2 of Glioma of the Retina.

The pathological changes accompanying the tumours are precisely those of pure glaucoma; and the average arterial enlargement is even greater, corresponding to the usually greater Tension. The muscle is also somewhat less atrophied, probably also in relation to the less average duration of the glaucoma; for the pain accompanying the glaucoma brings the patient under care early, and when the diagnosis of tumour is established, excision of the eye rapidly follows: thus, the Ciliary Muscle averages $\cdot393$, the Circulus, $\cdot054$, and its walls, $\cdot0028$ mm. The Iris is adherent in 4 cases, applied in 4, and free in 2. A little Iritis exists in all, caused apparently as in Group I. But there is one case in which the Iris has some adhesion to the Anterior Lens Capsule, and therefore, here at least, it is probable that its inflammation has preceded its application to the corneal margin. Schlemm's Canal is closed in 3 cases, of moderate size in 4, and large in 3. There is no specimen showing Schlemm's Canal open, and the adjacent Iris periphery free.

It is to be remarked that the muscular atrophy, as well as the dilatation and thinning of the Circulus Major, are as pronounced on the side furthest away from the attachment of the tumour to the Retina or Choroid as anywhere else. In fact, the changes are sometimes even greater on the distant side than close to the tumour.

Included in Group VII (— T) are also 3 eyes containing Sarcomata. In 2 the Tension has never been in excess, but the 3rd eye may not unlikely have been hard formerly. The Ciliary Muscle is bulky and tolerably well-developed in the first 2 cases, but in the 3rd, though it occupies considerable space, its structure is moderately atrophied. All these present a small Circulus Major, both near to and on the side away from the tumour. Its average diameter is .0194, and its average wall thickness .00716 mm.

One of these cases is that referred to in Group I in the observations on the conditions of Schlemm's Canal, as having slightly diminished Tension, with the Anterior Chamber of the Aqueous much narrowed or even blocked below.

The tumour mass implicates the Optic Nerve entrance in 2 cases of + T, and in one of the cases with — T.

A characteristic example of Group III is No. 367.

Clara W., æt. 23. Eight months ago she had double vision for a time. After this the *Left* eye gradually faded till perception of light was lost. Six weeks ago severe pain came in the *Left* side of the head and in the eye, which lasted till excision. The *Right* remains normal.

At Excision. *Left*, pupil dilated and fixed; no Iritis visible. Enlarged Anterior Ciliary Arteries visible in front. Greyish reflex from fundus. T 1.

Equatorial section. Ret. detached in loose folds, except at O.D. and Ora Serrata. It is also adherent at the apex of a dark-coloured smooth sarcoma, the size of a small bean, occupying the lower and inner quadrant of the globe, from close behind the equator up to the O.D., which is just involved in it.

Sections of the Upper Ciliary region show, Cil. Muscle, .44,

moderately developed; Circulus Major large, $\cdot 055$; walls thinnish, $\cdot 003$ mm. Iris base applied to Corneal Margin, some large blood-vessels in it, and possibly a very slight excess of nuclei. Canal of Schlemm of moderate size.

In the Lower Ciliary region, the Iris, Muscle, and Circulus are the same, but the Canal of Schlemm is large. Vertical sections of the inner periphery show the Long Internal Ciliary Artery much enlarged, diameter probably $\cdot 15$ mm., but its walls are thin, $\cdot 005$ mm., and collapsed. The Choroid here is absorbed in the tumour mass. There are no tumour cells in the Sclerotic.

Vertical sections of outer side show the Long Ciliary Artery slightly enlarged; the Choroid rather thicker than normal, apparently on account of enlarged blood-vessels contained in it. There may possibly also be a slight multiplication of nuclei in its Stroma.

The tumour has invaded all parts of the Optic Nerve entrance internal to the Lamina Cribrosa.

GROUP IV.

This comprises 19 cases, in which inflammation of some part of the Irido-ciliary-choroidal tract accompanies + T, and may be its immediate cause.

The inflammatory changes here are different from those very slight ones described as occurring sometimes in the Iris in Groups I, II, and III, and they differ in their course and appearances from the Iritis and its frequently-accompanying Cyclitis, met with in Group V. The forms of inflammation are various, it being due in most to some constitutional cause, such as Rheumatism, as in one case, or Syphilis, as in 2 cases. In 3 cases an injury has been followed by Plastic Inflammation, and in 3 more Suppurative Panophthalmitis has set in after accidental or operation wounds.

In this Group the changes in the Ciliary Artery and Muscle are much less conspicuous than in any of the preceding. For example, the total average muscular thickness is $\cdot 5038$ mm., the diam. of the Circulus Major $\cdot 0345$ mm., and its wall thickness $\cdot 0078$ mm. In fact, more than half

the Group (10 cases) present no special changes either in Muscle or in Artery. But the remainder (9 cases) closely resemble those previously described under Groups I, II, and III, in the condition of the Artery, though the walls are thin in 4 cases only. The Ciliary Muscle is tolerably well developed in all but about 5 cases.

In 9 cases, then, the inflammatory condition and the dilated arteries are found in company, and we may look to one or the other, or indeed to both combined, for the cause of the Tension.

In certain of them, however, there are strong reasons for thinking that the + T is not due to the inflammation. This is the case in the 3 eyes with suppurative Panophthalmitis; for in Group VII (with - T) we find 3 similar cases. And though these two sets of cases differ in their duration, and to some extent also in the parts more especially involved, yet the most striking difference between them is in the arterial diameter: for example, in the 3 cases with + T, the average diameter of the Circulus Major is .0468, while in the 3 with - T it is .0195 mm. The wall thickness is much alike in both sets, being greater than even in healthy eyes. The Choroid, however, is only implicated in one of the cases with - T to the same extent as in the others, though even this does not extend in any beyond some multiplication of scattered nuclei and oedema. In fact, there is no evidence in its condition at excision that the Choroid has been the starting point of the inflammation, or that by a Choroiditis Serosa it has produced the + T, which is not due to a purulent infiltration of the Vitreous either, causing an increase in its bulk; for in one of the cases + T goes with an actual diminution in its size and detached Retina.

The average duration of the 3 cases with + T is 10 days, and of those with - T one month.

As far as the arteries are concerned, the same observations apply generally to the cases with plastic inflammation of the Irido-Ciliary-Choroidal tract.

Thus the average arterial diameter of the 3 cases found in this Group is $\cdot 042$ mm., while that of the 6 similar cases in Group VII (with $-T$) and the one in Group VI (with T normal) together is $\cdot 014$ mm. The general microscopical changes are the same irrespective of the Tension. But the duration of the disease differs somewhat, the average of the first being 7 weeks, while in the cases with normal or $-T$, it is 11 weeks.

No enlarged artery can be recognized, however, in one of the 3 cases with $+T$, and the only condition that could possibly resemble it in its effects is the presence of large thin-walled blood spaces close to the internal choroidal surface, in the neighbourhood of the Ora Serrata.

To this explanation, however, I do not think we are justified in attaching much importance, and the case remains as an important exception. I regret very much that its Long Ciliary Arteries were unexamined. Clinically, this form of inflammation is frequently observed to be accompanied with varying Tension, an increase being usually found in its earlier stages; while later on $-T$, with a shallow aqueous chamber, is more frequent.

The Ciliary Muscle is well developed in these as in Suppurative Panophthalmitis, and this is probably due to the fact that excision in these cases followed comparatively rapidly on the establishment of the disease. The same remark applies generally to the walls of the artery.

One of the cases of Plastic Choroiditis is so interesting that I give it briefly here. It will be seen to be probable that the enlarged arteries and the inflammation are both directly caused by the accident, and that therefore the case would have been more properly included under Group II.

No. 371. Thomas M., æt. 40. A blow, 3 weeks before excision, ruptured his *Left* globe along the upper Sclero-corneal margin. Pain began 2 days later and continued till its removal; then there was a dull reddish reflex from the fundus, with the barest perception of light and $T2$.

Equatorial section of the globe shows the whole Iris and Lens to be absent; they have probably escaped through the rupture. The Vitreous is partly opaque; it contains blood; its central part is thin and syrupy. There are extensive patches of Plastic Choroiditis.

In the *upper Ciliary Region* the muscle measures $\cdot 28$; its structure is fair. The diameter of the Circulus is $\cdot 043$; its walls, $\cdot 008$ mm. The Canal of Schlemm is closed.

In the *lower* the muscle measures $\cdot 38$, structure fair. Circulus, $\cdot 040$; walls, $\cdot 008$ mm. Canal of Schlemm open.

The *Long Internal Ciliary* is much enlarged, and its walls are thinned. Diam. = $\cdot 086$ mm; walls, $\cdot 005$. There was no Staphyloma corresponding to it.

The Optic Disc is not cupped, but there is more curving back of the Lamina Cribrosa than is normal.

The other eye is a little irritable, but its vision and accommodation are perfect.

Therefore in the 3 cases of Suppurative Panophthalmitis and the 2 of Plastic Inflammation of the Choroidal tract, I connect the increased Tension with the enlarged blood-vessels. I can speak less decidedly as to the influence of this condition on the 4 remaining cases in which it occurs.

For in Case No. 229, a man, $\text{æt. } 46$, though the choroidal inflammation is of long standing, and not now acute, yet there accompanied it at the time of excision Iritis and Hypopyon, together with a recent Corneal ulcer. The Circulus is extremely large, and its walls very thin.

And in Case No. 226, a woman, $\text{æt. } 28$, there is great Iritis, with excluded pupil and adherent base of Iris, together with a little Cyclitis, and slight multiplication of nuclei in the Choroid generally. There have been corneal nebulæ, and also some changes in the Iris since childhood. The Circulus Major is moderately enlarged with thin walls.

No. 342 is a girl, $\text{æt. } 8$, with congenital syphilitic disease. The Iris is inflamed and adherent to the Cornea. There is inflammation of the Ciliary body of long standing, with great atrophy of the Ciliary muscle. The Choroid and Retina, adjacent to the

Ora Serrata, are inflamed, with considerable multiplication of the Retinal pigment epithelium. And in addition to a general bulging of the thinned Cornea and adjacent Sclerotic with its atrophied Ciliary body, there are indications of an accumulation of fluid between the Sclerotic and Ciliary body itself. The Circulus in the atrophied Muscle is moderately enlarged, with extremely thin walls. There is also considerable enlargement of the Long Internal Ciliary Artery, and of the space surrounding it and the nerve in their Scleral tunnel. The Optic Disc is cupped.

In the last Case, No. 147, there is, together with Iritis of 20 years' standing (possibly specific), more recent Choroiditis near the Ora Serrata, corresponding to which there is a local Scleral Staphyloma of the Upper Ciliary region. There is moderate multiplication of nuclei in the Iris, and the Pupil is excluded. The Ciliary Muscle is atrophied, and the Circulus much enlarged and thinned, especially above, near the Staphyloma. There is a large deep cup, indicative of long standing + T.

Judging from the history and appearances, I conclude that in the first 3 of these cases, and probably also in the 4th, the Tension is due, principally at all events, to the same causes as in the three groups previously treated of.

One of the remaining 10 cases (those without enlarged blood spaces) has already been discussed as a case of Plastic Choroiditis. In another Iritis Serosa was diagnosed during life, and appeared from the increased depth of the Aqueous Chamber to be the cause of the + T. And as a similar microscopical condition was found affecting the Ciliary tract and Choroid, it is probable that a Serous Cyclitis and Choroiditis participated in causing + T. In this eye the Ciliary Muscle was well developed, the Iris periphery free, and the Canal of Schlemm open, though surrounded by an excess of nuclei. The Circulus was of normal size, diam. = .022 mm., and its walls of average thickness, .004 mm. The Long Ciliary Arteries were not examined. There were no staphylomata visible anywhere. The condition of the supra-choroidal space, and of that surrounding the Long Ciliary Artery and nerve while perforating were not determined.

Of the 8 cases left, three have great Irido-Cyclitis. This is attributed in one case to Rheumatism, and in another to Syphilis. Both have excluded pupil. In the Rheumatic case and in the 3rd one, the inflammation may have been aggravated by a recent attempted Iridectomy, though the T, as evidenced by the history and the appearances of the Optic Disc, is of much longer standing than this.

Microscopically, I see nothing to distinguish the Cyclitis occurring in 2 out of these 3 cases at least, from what will be described as sometimes met with in, and even typical of, the next group.

Only 5 cases remain, and these are interesting as presenting some points of mutual affinity, though the proper position of one of them (No. 185) is somewhat doubtful. In these Choroiditis appears to have been the primary, and still remains the principal affection, for though some little Iritis is found, it is scarcely more conspicuous or important than in the cases of Group I. The Choroiditis differs from any previously referred to as occurring in this Group. Though I see nothing else to account for the + T, yet I am unable to say that this inflammation differs microscopically to any great extent from that which is rarely or ever accompanied by + T, as for example, Choroiditis disseminata.

The first 2 of these cases seem the most striking, as having been examined more recently, and therefore more fully than the others.

No. 214. Joseph K., æt. 56. Fourteen weeks before excision a blow dislocated the Lens of his Right eye. Its Vision was afterwards dim and confused, but there was no pain. Tension was normal. Three weeks later the Lens was removed, and during the operation Vitreous was lost. Iridectomy was attempted at the same time, but the unremoved base of the Iris remained entangled at its free end in the operation wound. Constant pain in the eye then came on till excision was performed, on account of the irritable condition of the other. Then T 2.

In the Upper Ciliary region the Iris was entangled in the

slightly bulging scar, its base adherent, and its intervening portion loosely applied to the Cornea; there was trifling Iritis and Cyclitis. The muscle was well developed. The Circulus was normal, and the Canal of Schlemm open.

Below: the Ciliary region and Iris were normal, with the exception of slight Iritis and Cyclitis, as above.

The Vitreous was fluid and clear, except a small hazy, opaque, white spot at its lower part.

The Optic Disc presents a small shallow cup, not reaching to the margin. The Lamina Cribrosa is slightly curved back.

The Choroid and Retina are *in situ*. Near the inner equator is a small coal-black area, with a lighter centre. A microscopical examination of this shows that the retinal pigment epithelium is densely black and increased in thickness; root-like processes extend inwards from it into the Retina. The granule layers thus penetrated have lost their precise boundaries, and nothing can be made out but nuclei, resembling the granules in shape, loosely scattered as far internally as the nerve cell layer. The rods and cones have entirely gone. In the Choroid, just external to the pigment, there is a greyish rounded exudation mass, whose structure is irregularly and indistinctly fibrillated, and which contains a few rounded nuclei scattered through it, and more surrounding it.

The Internal Long Ciliary Artery and its accompanying nerve, in which are excess of nuclei, are surrounded in their scleral tunnel by a clear space of considerable size. The Choroid has separated from the Sclerotic in every specimen, so that it is uncertain whether the supra-choroidal lymph space was enlarged or not. There were no scleral staphylomata. No sections were obtained, showing the External Long Ciliary Artery and Nerve in their passage through the Sclera.

Case No. 231. Dinah H., æt. 36. She had a blow upon her *Right* eye with a piece of wood, 19 years ago. When discharged after a stay of six weeks in hospital, some opacity of the Lens near its posterior surface remained, but otherwise the eye seemed well. She could see her way about with the *Right* alone. The *Left* had good vision, which it still retains.

Six months ago the *Right* came dim, and lately it has been more so. Pain came in it 4 days before its removal, which was performed on account of irritation of the other.

At excision, there are some small posterior synechiæ. There is

a bluish-black, patchy, atrophic appearance of the ciliary region all round, just behind the Sclero-Corneal junction. On the globe being opened, the Iris periphery is seen applied above and below; there appears to be no Iritis, the Canal of Schlemm is visible below, but not above. The muscle is good on both sides. The Circulus Major is normal. There is a well-marked staphyloma of the Sclerotic, just behind the sclero-corneal junction; the bulging appears to be due to an accumulation of fluid between the Ciliary Muscle and Sclerotic, separating the two, and penetrating among and opening out the most external fibres of the Ciliary muscle.

The Retina is detached in loose folds, except at the O.D. and at its ciliary attachments. The Vitreous is thin and yellowish. The O.D. presents a shallow cup over its whole surface. On either side of it are two irregular black circles, each enclosing a greyish-pink area; a larger white atrophic choroidal patch is also near.

Microscopical sections through the patches of diseased Choroid show the black and thickened Retinal pigment layer adherent to it, except at the centre of the patch, where it is deficient. Lying internal to this is a layer thickest at the centre of the patch, and tapering off to its sides, which appears to be very indistinctly fibrillated, and has scattered through it a few round nuclei. The Choroid corresponding to this contains a slight excess of nuclei in places, but is generally thinner than normal. In the specimens the Choroid is always detached from the Sclerotic, but there are indications of an enlarged Supra-Choroidal space. The Long Internal and External Ciliary Arteries are normal, but they and their accompanying nerves are surrounded by an enlarged scleral tunnel.

Besides their somewhat similar microscopic appearances, there is evidence in the clear space surrounding the Long Ciliary Nerves and Arteries, that the 2 cases above described are of the same nature. It is likely that more exact examinations of Choroiditis or Choroido-Retinitis accompanied by + T, will reveal points distinguishing them microscopically from inflammations of the same structure, which are rarely accompanied by Tension.

The next two cases were examined in 1876-77, and, consequently, their record is not complete. In them the existence of Choroiditis is indicated by a staphylomatous

bulging of the Sclerotic of the upper and outer side of the eye in front of the equator. The Choroid corresponding to the centre of the staphyloma is in each case very thin and atrophic. It is very closely applied to the Sclerotic. The pigment epithelium layer over it is thickened, and is constituted of small irregular brown cells.

In Case No. 61, the margin of the Staphyloma borders on the upper ciliary region. The sections of this show the affected choroid to have the epithelium lying on it thickened and irregular. Its stroma is moderately infiltrated with round or elongated deep-staining nuclei.

In the second Case, No. 160, the margin of the staphyloma is not well seen in any sections, but the ciliary region in front of it has an irregular multiplication of the pigment of its anterior part somewhat like, though less pronounced and abundant than, what is seen in some cases of the next group.

I class these 2 cases with the preceding 2, for though in them the Choroid has arrived over a considerable area at an atrophic condition, there is in one of them, at least at the edge of the diseased patch, an increase of nuclei in its structure, and a similar alteration in its pigment epithelium. In the other the direct evidence of affinity with the first two is less clear, but the microscopical appearances of the Choroid in the centre of the staphyloma link it to the 3rd case. Unfortunately the Long Ciliary Arteries were not examined in their course through the Sclerotic in either case.

However, all four are further associated, in that there is present in all but the iridectomized case (No. 214) a true Scleral Ciliary Staphyloma above. The accumulation of fluid between the Ciliary muscle and Sclerotic causing this is interesting, taken in association with the enlarged space round the Long Ciliary vessels and nerves.

Neither enlarged spaces round the Long Ciliaries, nor any forms of Scleral Staphyloma have been met with in any of the cases of Groups I, II, III, and the general Corneal and Scleral yielding sometimes caused in the next Group

by pressure from within, acting on a thinned Ciliary muscle and Sclero-Corneal region, differs altogether from the Ciliary staphylomata found here. Of course local staphylomata also may occur in tumour cases by the yielding of a Sclerotic weakened by an extension of the tumour cells into it.

The true Scleral Ciliary Staphyloma is met with in two more cases of Group IV, one (No. 185) of which a short account will be given below, and another (No. 147) briefly described above, as possessing marked glaucomatous arterial changes. This globe has also a marked Scleral Staphyloma between its Superior and External Recti muscles. Some Choroiditis is visible near the anterior margin of this.

The other remaining case of this Group (No. 185) is a peculiar one. It has a Scleral Ciliary Staphyloma and also a little Choroiditis. But besides this, the Iris is inflamed and adherent to the Cornea throughout, consequent on its prolapse into an old rupture. In this respect it closely resembles the next Group with which perhaps its affinities are stronger. I briefly quote it.

No. 185. Sarah M., æt. 19. Eleven years ago she pricked her *Right* eye near its outer corneal edge with a fork. No notice was taken of the accident, but 12 months later its sight was found to be much deteriorated. She has had slight pain in it for some years, but more within the last 12 months. The *Left* eye is normal.

At excision, *Right* has +T; no perception of light remains. A swelling is seen to the outer side of the Cornea containing the remains of the Lens which had escaped under the Conjunctiva, through the ruptured Sclero-Corneal junction. There is a line of pigment in the scar representing the remains of the Iris. The Globe is enlarged. The Vitreous is fluid. The Ciliary muscle is generally well developed. The Circulus Major is a trifle large; its walls are fairly thick. The Iris is represented by a line of pigment in the scar of the rupture. Elsewhere it is closely adherent to the Cornea, and its nuclei and uveal pigment cells are increased in number.

Near the scar the Ciliary body has its pigment epithelium

thin and a little irregular, as if from old Cyclitis. Here the muscle also is rather thinner, and just behind the Ora Serrata is a small greyish patch of Choroiditis, which was not examined microscopically.

There is a large staphyloma of the Sclerotic of the upper Ciliary region, corresponding to which the outer fibres of the ciliary muscle are separated. The Optic Disc presents a moderately deep universal cup. The Long Ciliary Arteries were not examined.

The microscopical appearances of the Iritic and Ciliary affection resemble those found in the next group.

Among the 19 cases forming this Group, there are several in which the pupil is excluded. In two of those briefly quoted, an Iridectomy which has removed this condition has produced no effect on the Tension. But in both there was at excision an acute inflammation of the Irido-Ciliary tract.

Many cases with excluded pupil are found in Group VII (—T). To this, however, much importance need not be attached, as clearly no such exclusion would have the effect of raising the tension of a shrinking eye.

More interesting is a case of Buphthalmos (No. 773) belonging to Group VI. Here the Tension is noted normal at excision, though the Optic Disc shows that it was for a long time increased. The patient is a boy 5 years old. His parents say that the eye (the left) was large at birth. The measurements of the whole globe are increased, but the anterior chamber of the Aqueous is especially deep. The Iris is adherent to the Lens Capsule throughout, so as to thoroughly cut off communication between the Aqueous and Vitreous Chambers. Notwithstanding this, Schlemm's Canal is extremely large, and its communications with the anterior chamber are very patent, owing to the wide angle between the base of the Iris and the Cornea.

There is scarcely any evidence of present Iritis or of inflammation of any other part of the eye. The Circulus Major is rather large, but its walls are of normal thickness.

The Ciliary Muscle is well developed. The Retina and Choroid are *in situ*. The Optic Disc is cupped. The Long Ciliary Arteries were not examined.

Doubtless the very fact of the pupil being excluded is an indication that Iritis has preceded the Tension. For had there been none, the Iris instead of being in contact with the lens at its pupillary margin would have been pushed forwards, so that no adhesions could be subsequently formed, except to the Cornea.

The Anatomy of Cysts of the Iris shows that secretion of fluid from its posterior surface takes place, sometimes at all events. And the bulging of it forwards, frequently seen in excluded pupil, is evidence in the same direction. Some facts will be put forward while discussing the next Group, as to the connection of the pigment epithelium of the Iris and Ciliary body with the secretion of fluid. The Tension in two cases of Choroiditis previously recited (Nos. 214 and 231) might be explained by supposing that the Retinal pigment epithelium may have or take on a similar function.

I will, however, readily admit that Exclusion of the Pupil may have an effect in keeping up the Tension, possibly by cutting off access to Schlemm's Canal, or by preventing transudation into or through the Cornea.

Either explanation would help us much in certain cases of the next group, where an atrophic pigmented layer, representing the remains of the adherent Iris, is applied to the posterior corneal surface throughout.

GROUP V.

This series of cases is one well marked clinically. It consists of 22 cases in which the Tension has followed a Corneal Staphyloma in which the Iris is also involved. This condition is, in nearly all the cases, the result of the prolapsing of the Iris into a perforating Corneal ulcer. There are peculiar inflammatory changes in the Iris, and

usually also in the adjacent Ciliary region. But the vascular changes characteristic of pure Glaucoma are missing in 16, and are only superadded to the other conditions in 6 cases, in most of these even at a much later period and to a much less extent than in Groups I, II, and III.

Thus, in the whole of Group V, the average diameter of the Circulus Major is $\cdot 0273$ mm., and its average wall thickness $\cdot 0058$ mm. And if the 6 cases be excluded, in which the artery is dilated, the average of the remaining 16 is, muscle, $\cdot 441$ mm.; artery, $\cdot 02186$ mm.; walls, $\cdot 0067$ mm. These figures differ very little from the averages of diseased eyes with normal Tension (see page 380).

In all of the cases the Iris is stretched forwards, and is adherent to the Cornea at the Staphyloma, usually throughout its whole extent. But in three cases of this Group one limb only is thus involved, though even in these the Iris periphery is adherent all round. Thus access from within the globe to Schlemm's Canal is prevented in every case. The prolapsed Iris is soon covered with lymph which organizes and forms ultimately a leucoma. The Iris in the neighbourhood of this becomes much inflamed and irregularly thickened, its nuclei are multiplied, its Uveal pigment increased and irregularly disposed. The rest of the Iris is stretched, thinned, and applied to the Cornea, to which its base becomes adherent. Though at first inflamed, it rapidly becomes atrophied, till, in many cases, but little is left except a web of pigment clinging to the posterior corneal surface.

The Aqueous Chamber posterior to the Iris gradually increases in size as the cicatrix and whole Cornea also gradually yield. This general yielding is partly due to the increased pressure, but partly also, perhaps, to some change in the Corneal tissue coincident with the affection of the Iris adhering to it, which renders it more yielding. For this staphylomatous bulging occurs where the Cornea is actually thickened and vascular.

But, should the Lens have also become adherent, the

Corneal cicatrix sometimes ceases to yield and becomes very thick and opaque. The Aqueous Chamber is not enlarged, and the increased pressure is transmitted to the Vitreous Chamber.

But so long as the Aqueous Chamber enlarges, there is very little increase of pressure in the eye as evidenced by palpation, and by the state of the Optic Disc. The pressure is also kept somewhat down by a very gradual increase of all the measurements of the eyeball, if the patient be young.

The process may cease here, but in nearly all cases the multiplication of pigment very gradually extends to that covering the Ciliary body. Hitherto the Ciliary muscle has remained quite unaffected, but now its nuclei increase at the same time as the pigment cells and other elements covering it internally. Finally, though gradually, this excess disappears, leaving the muscle either moderately developed, as in the milder cases, or extremely thin. With its atrophy a general Scleral and Corneal thinning takes place, which may yield to the pressure within the globe, thus forming sometimes a general staphylomatous bulging of this region. The pressure causing this condition comes from within the Vitreous and Aqueous Chambers, and is not due to an accumulation of fluid, as in the last Group, between the Ciliary muscle and Sclerotic. But there are two cases here in which true *Scleral* Ciliary Staphylomata are met with.

Sometimes the pigment increase is chiefly confined to the apices of the Ciliary folds, which are thus darker in colour than normal. They are also sometimes stretched forwards towards the apex of the Staphyloma by the advance in the position of the Lens, which is sometimes met with in these cases, by reason of its adhesion to the Cornea.

But sometimes the pigment covering the Ciliary body internally is also multiplied, and a very characteristic appearance may be presented. In the most typical cases

the pigment layer is of many times its usual thickness. The outermost cells are perhaps somewhat lighter in colour than normal, but internally they gradually shade off into a loose irregular stratum of still less pigmented cells, intermixed irregularly with the most internal of which is a loose mass of unpigmented cells. These are sometimes seen to be bounded internally by a distinct layer of nucleated cells.

I think, from one of the cases quoted below (No. 364), that the Ciliary body when first affected presents simply a multiplication of the pigment cells contained in the loculi internal to and formed by extensions from the Vitreous Lamina covering it. Further observations are, however, required on this subject.

Of the 22 cases comprising this group, 18 present Iritis in an active condition. In 4 of these the Iritis is combined with the changes in the Ciliary body, which I have described as typical, and of these 2 present, in addition to the Iritis and Cyclitis, the typical Glaucoma dilatation of the arteries.

In the 4 remaining cases Iritis is not a prominent condition in any of my specimens, indeed atrophic changes are far more conspicuous in the Iris. The Tension might perhaps be accounted for in two of them by the dilated arterial condition which occurs in both to a moderate extent. The other two seem neither to have a dilated Circulus Major nor Iritis, nor any acute Cyclitis. But one of them (No. 224) has, however, its Long External and Internal Ciliary Arteries enlarged. It has also a Ciliary Scleral Staphyloma, but the Circulus Major was scarcely recognisable in the atrophied layer representing the muscle. The eye was lost, and apparently also hard since infancy (19 years).

The other case (No. 109) has also been blind since infancy (12 years). The Cornea and adjacent Sclerotic were thin. The Ciliary muscle was vastly atrophied, and in it the small Circulus could scarcely be recognised.

There was great multiplication of the pigment of the posterior part of the Ciliary Circle, but it seemed rather like the remains of former inflammatory changes, as there were no unpigmented cells mixed with or superficial to the loose pigmented layers. The Long Ciliaries were unfortunately not examined, though thinning is noted both on the inner and outer side of the Optic nerve entrance. The examination of this case was made in 1876.

Such cases are difficult to explain. It is, however, not unlikely that a more minute or extended examination would have shown parts of the Iris or Ciliary body in a state of active inflammation. But apart from this there is little to fall back on besides the adhesion of the Iris to the Cornea. This would have the same effect as an excluded Pupil, about which something has been already said in treating of Group IV.

The above-described condition of the Ciliary body and Iris inclines me to the belief that an increase of the pigment epithelium of either or both may cause plus Tension. But evidence from other sources confirms this but partially. For example, there are certain cases in which, if this pigment layer has normally for its function the secretion of fluid within the eye, the Tension should be minus, for in them the pigment epithelium cells are disintegrated, and fine black granules are loosely scattered over an extended area evidently corresponding to that occupied by the formerly multiplied cells.

This condition is characteristically seen in 4 cases. Three of them have -T, the 4th one, not quite, however, so typical a case, has +T. In this exceptional case (No. 83) the Iris is still inflamed. The Circulus Major, though rather large, yet seems not sufficiently so, judging from the cases of the other groups, to account for the Tension. The Long Ciliaries were not examined.

But it is in examining Groups VI and VII that we find the greatest difficulty in determining the relation of the changes in the pigment to the Tension. In these

there are 5 cases in which normal or —T has followed +T due to Corneal Ulcer with entanglement of Iris. The Iris is distinctly inflamed in 2 of these cases, nor can I detect any difference between its inflammation and that of cases of Group V, except that it is less acute than in most of these. In the other 3 there is certainly no marked atrophy of the pigment of the Ciliary region, though there has formerly been inflammation, and though the Iris is atrophied, yet this is a condition which has been described as being found, together with +T, in several of the cases of Group V.

And though the Iritis in this Group is peculiar, inso-much as it has taken its origin in a special manner by means of the Corneal Ulcer, and though it is not attended with secretion of pus but with pigment multiplication, yet I am unable to say from microscopical examination that there is anything in the Iritis so excited that distinguishes it from any other form. But on the other hand I have seen a slight apparent increase of pigment in Suppurative Iritis and Cyclitis without +T, though in these cases the pigment was intensely black and more irregular than even in Group V.

This being so, one turns to the other conditions found in this Group, to see if they offer any explanation of the Tension.

Corneitis always precedes the Iritis, and in one case this was attended with inflammation, adhesion, and atrophy of the Iris limb corresponding to it, though there was no perforation. But as the Iris is closely adherent to the Cornea, the increase of fluid may have come either from the posterior Iris surface or from the Vitreous Chamber, and cannot possibly be derived from the posterior Corneal surface.

In every one of these 22 cases the Iris is adherent at its base to the Cornea, indeed there are only 3 cases in which the entire Iris is not applied. In them one limb is free except at its base.

Thus the Canal of Schlemm, though it is open more or less in 12 cases, yet has no apparent function in any. But I am unable to say whether its condition has had any part in causing + T. I have come to the conclusion that it has exerted little or no influence in the preceding Groups. Certainly the 3 cases of Group V, in which one limb is free except at the base, seem to show that the pushing forwards of the Iris, and consequent closure of the Canal, occurs second to the increased Tension.

I have referred to the fact that the Canal of Schlemm may be blocked in part of its circuit, and the Tension remain normal or even be slightly diminished.

A case, previously referred to as having the Anterior Chamber and Schlemm's Canal below nearly or quite blocked by a Sarcoma of the Iris, has a slight diminution of T, together with nearly perfect vision.

In this Group the Iris lining the Cornea would check any transudation of fluid through it, except partially in the 3 cases in which one limb is partly free, supposing that any such transudation normally takes place, and that, as seems likely, the Iris is impermeable to fluids.

It is possible that the stretching forwards either of the Iris or apices of the Ciliary processes, may set up some nerve irritation which may cause hypersecretion or increased transudation; but this is of course purely speculative.

In connection with Group V, the following cases deserve recital.

No. 364. Joseph R., æt. 40. Eyes quite well till 9 weeks ago; then he had pricking pain and watering of the *Left*. He had no treatment till he came here 6 weeks later. Then there was a large bulging Staphyloma of the lower $\frac{1}{5}$ th of the Cornea. The unaffected part of the Cornea was tilted upwards and forwards. The Pupil was much dilated, its lower part involved in the Staphyloma, the Lens hazy, and Vitreous clear. The Optic Disc looked hazy. T 2. The *Right* was normal.

Things remained the same till excision. Then the globe was

found to be 30 mm. long to the apex of the Staphyloma, which measured about 7 mm. from above to below, and 14 mm. from side to side. The Cornea is thin near the apex of the Staphyloma, but thick and irregular at its margin, beyond which the Sclerotic looks normal. The Aqueous Chamber is very deep. The entire Iris limb is adherent to the Cornea below; for the most part it is represented only by a thin pigmented layer, but near its apex it is inflamed and thickened. The Muscle of the lower Ciliary region is somewhat thinner than above, where it is about normal. There is apparently some slight multiplication of the pigment cells below, but still they are quite regularly disposed as pigmented processes extending outwards towards the muscle from the general level. Their colour is perhaps somewhat diminished in intensity. The Circulus Major as seen both above and below is rather small. The Iris base is adherent above. The Long Ciliary Arteries are rather large, but there is no special wall thinning; there are no Staphylomata in their course. The Vitreous is more fluid than usual. The Optic Disc presents over $\frac{3}{4}$ ths of its extent a shallow depression. In other respects the eye appears normal.

No. 248. Sarah H., æt. 17. Her *Right* was lost in infancy with perforating ulcer from Ophthalmia Neonatorum. Judging from the usual course of such cases in this Group, increased Tension probably followed, though the Tension afterwards became less than normal, as evidenced by the size of the eye, its diameter being about 19 mm., and by a groove extending from the Inferior Rectus insertion to the adjacent corneal edge. The Cornea is small and opaque, it has indications of marginal thinning above. T 2.

Microscopic examination: The Ciliary muscle has generally good structure, it measures .38 mm. There is some enlargement of the Circulus Major at the lower part of its course, its walls are however fairly thick. There is vast multiplication of the pigment of the Ciliary region all round, with abundant scattered unpigmented cells mixed with and lying internal to them. There are large deeply staining colloidal globes on the internal surface of the basement membrane of the Choroid. The Retina is detached. The Iris is thin, adherent, and inflamed. The Long Ciliary Arteries are about normal. The condition of the Optic Disc is doubtful, on account of the Retinal detachment. The

Left eye has good vision, though it aches occasionally, and its Tension is slightly increased.

No. 363. George C., æt. 14. His *Right* eye has, from Ophthalmia Neonatorum, a prominent corneal Staphyloma whose apex is below the horizontal line. There is a slight bluish thinning of the corneal margin above. The Tension is increased. He never remembers to have had either perception of light or pain in it.

On Equatorial section the Vitreous is seen to be fluid, except a little at the lower part of the Ciliary circle. The Lens is represented by a cartilaginous-looking nodule adhering to the posterior corneal surface at its lower part. The Optic Disc is deeply cupped, though containing many nuclei. There is a small atrophic crescent to its outer side.

In the upper Ciliary region the Iris is adherent, as a web of pigment, to the upper corneal margin. The apices of the Ciliary processes are much stretched forward. There is vast increase of the pigment of the ciliary region into brownish-black irregular layers, intermixed with or internal to which are abundant loosely arranged nucleated cells. The Circulus Major is represented by an enormous thin-walled cavity, diam. $\cdot 068$ mm., walls $\cdot 002$ mm. The muscle measures $\cdot 35$ mm., its structure is moderately good.

The lower part of the Ciliary region is generally the same, but the muscle measures $\cdot 2$ mm. only. The cavities in the apex of the muscle are also considerably less large than above; diam. $\cdot 045$ mm., walls $\cdot 002$ mm. thick. Vastly inflamed patches of Iris are found occupying irregular depressions on the posterior corneal surface.

GROUP VI

(diseased eyes with normal T) includes 30 cases. The average thickness of the Ciliary Muscle is $\cdot 597$ mm. The diameter of the Circulus Major is $\cdot 028$ and its wall thickness $\cdot 0079$ mm. Only two cases of this Group present a very large Circulus, as in Group I. Both were examined 3 years ago and, most unfortunately, specimens were prepared from one part only of the Ciliary Circle. One case is No. 79.

Arthur B., æt. 21. His *Right* eye has the whole Cornea densely leucomatous, apparently being so since birth. He never re-

members any vision in it. Though the whole globe is enlarged, especially in an antero-posterior direction, it is so sunken that its presence could hardly be recognized by inspection during life, nor could the Tension be well determined. After excision this was registered as normal.

On examination after excision: The Iris is quite free and the Canal of Schlemm large. All round the O. D. is a large thinned staphylomatous area, involving the yellow spot. Corresponding to this the Choroid is atrophied. The Ciliary muscle is well developed, $\cdot 63$ mm.; the Circulus Major is large, $\cdot 065$ mm., and its walls thin, $\cdot 003$. The Vitreous is rather fluid. The left eye has a total hypermetropia of about 3 D.

This is a case whose relation to Group I and whose real nature might give rise to much discussion. The other is No. 21.

Maria C., æt. 35. She has severe corneal ulceration with hypopyon, from a blow 24 days before excision. In the Lower Ciliary region the muscle is well developed, measuring $\cdot 6$ mm. The Circulus is large, $\cdot 087$, and its walls of relative slight thickness, $\cdot 0086$ mm. The Iris is free and Schlemm's Canal of moderate size. The Optic Disc is swollen.

The cases standing next to these, in respect of their arterial measurements, average $\cdot 034$, $\cdot 033$, $\cdot 032$, $\cdot 031$ (two cases), and $\cdot 030$ mm. respectively. In all these the walls are of fair thickness. No other cases of this Group exceed $\cdot 029$, or have thin walls.

The case with largest diameter ($\cdot 034$) is that of a man, æt. 32, in whom Glaucoma followed a slight injury 15 years ago. The Globe is enlarged, the Iris periphery adherent, and the Optic Disc deeply cupped. The walls of the Circulus are very thin. T was recorded as normal at excision.

The next two cases are extremely myopic eyes, the first of which was removed on account of long-standing corneal ulceration. The fourth (No. 773) is a case of Buphthalmos with excluded pupil and vastly deep Anterior Chamber. The Tension had previously, without doubt,

been in excess, though it was recorded as normal at excision. This case has been already referred to (page 412).

The two next succeeding in size have cicatrices of old corneal ulcers, in which the Iris is entangled. Their tension was formerly in excess. In one a recent Iridectomy has reduced it to the normal. The case next in order of size to the above is one of Acute Plastic Irido-Choroiditis.

The nature of the cases just recited is interesting in relation to the Groups previously described.

The condition of Schlemm's Canal and of the Iris periphery has been already referred to under Group I.

The remaining eyes in Group VI were excised on account of various causes, such as Corneal Ulceration, Iritis, and Keratitis, specific and otherwise, &c.

GROUP VII

(with — T) has a muscle nearly as bulky, on the average, as that of healthy eyes, and exceeding that of Group VI. But in this respect measurements are somewhat faulty, as the texture of the muscle is in many cases very thin, and in several a contracting Vitreous has, by separating the fibres, increased the apparent bulk of the muscle. The cases where the muscular structure is atrophied are those which have had, as indicated by their history and by the condition of the Disc and Iris, a previously increased Tension.

The Arteries average less than in Group VI. Speaking generally, it is a fact that a smaller arterial diameter is associated with — T. But there are certain exceptions, as in the last Group. The one most marked (No. 161) has an average arterial diameter of .04 mm., with good walls (.01 mm.). The muscle is well developed and the Iris periphery free. The limb of the Iris is entangled on one side in the scar of an old Iridectomy wound. The pigment of the Ciliary region on the side opposite to the Iridectomy

is scattered and atrophied. There are elsewhere indications of chronic Irido-Cyclitis and of extensive old Choroido-Retinitis.

The next case (No. 220) has an arterial average of $\cdot 036$ mm.

It is a man, æt. 58, whose *Left* eye was burnt by a firework explosion 9 weeks before its excision. A great part of the Ciliary circle and Iris exhibits vast atrophy and scattering of its pigment, black granules scattered over an extended area alone remaining. The Cornea is opaque and vascular. The Canal of Schlemm is open. The Iris margin is loosely adherent and the muscle fairly developed.

Another exceptional case in respect of the artery is No. 217.

A man, æt. 24. His *Right* eye has been the subject of chronic Irido-Choroiditis. The T appears to have been formerly +. A large Iridectomy was done outwards 9 months ago. The base of the Iris remains, however, adherent to the Cornea here, this condition having apparently preceded the Iridectomy and not been altered by it. There is great excess of nuclei round the slightly adherent base of the Iris on the opposite side of the Ciliary Circle and in the part of the muscle adjacent to it. The Canal of Schlemm is open. The Circulus averages $\cdot 036$ mm. The Choroid is affected all over, being partially covered internally by bone.

Five more cases with — T, average more than $\cdot 026$ mm. One (No. 183) is a case with excluded and occluded pupil after Syphilitic Iritis (acquired). This case is a typical instance of the scattered granular atrophic condition of the pigment of the Ciliary body already mentioned. Another (No. 189) has long-standing Irido-Choroiditis, excluded pupil, and detached Retina. The third (No. 190) was excised 57 days after a perforating wound, which resulted in Suppurative Irido-Cyclitis. The fourth was excised 28 hours after a perforating wound of Cornea, Iris, and Lens; and the last, on account of a very thin yielding

Corneal Cicatrix, after ulceration due to Gonorrhoeal Ophthalmia.

These 2 last can scarcely be said, however, to be cases with — T, properly speaking, as the decrease is due to the increased capacity of the globe, or to the escape of fluid through the open wound. The measurements of the great majority of the remaining cases are extremely small, as will be inferred from the average of the entire group. These measurements are put in contrast with others on page 380.

The examination of the 13 cases, in which Iridectomy has been performed, is instructive.

Six of these belong to Group I, and in none of these, of course, has the operation reduced the Tension. Excision has in most taken place within a few weeks of the Iridectomy. Notwithstanding the great proportion of cases in which a dilated Circulus Major is found in this Group, yet in only one case out of these six, do dissections show the Circulus enlarged at the part of its circuit corresponding to the Iridectomy. In all the 5 it is not large, varying from $\cdot 034$ to $\cdot 007$ mm., the total average being $\cdot 021$ mm. In only one case is the vessel on the opposite side as small, the average of these being $\cdot 048$ mm. The totally exceptional case (No. 303) is recited above (page 395) as having a much-dilated Long Internal Ciliary, together with a normal-sized Circulus Arteriosus Iridis Major: thus, among the 6 Iridectomized eyes are found twice as many with the Circulus unenlarged at its upper part, the Iridectomy having been done upwards in all, as among the remaining 21 cases together.

Speculating as to the reason of this astonishing fact, I can only suggest that either the Iridectomy chances to have been done on that very eye and in that region of it in which the Circulus is small, or that the operation has reduced the size of the artery, either in part or throughout the whole of its extent. On a comparison of the figures involved, the first supposition seems extremely improbable.

In connection with the second, the cases in which - T exists in eyes formerly Glaucomatous show that a diminution in the arterial size has in all probability occurred (see page 384).

It is possible that Iridectomy cures by tearing or removing the base of the Iris near a dilated vessel, and that it fails when the T depends on other causes.

It is proper to observe that in only one case (No. 303) does the operation appear to have been well done. In three the Iris was left entangled in the scar, thus setting up great Iritis; and in the remainder the adherent and atrophied condition of the Iris base has prevented its removal by the operation. It is but just to say that very few of these operations were performed at Moorfields Hospital.

Iridectomy has been done without avail in 3 cases of Group IV. In 2 the Iris is left in the scar. The remaining one in which the pupil has formerly been excluded shows great Iritis and Cyclitis, though the Iris has been perfectly removed.

Group VII (- T) contains 4 Iridectomized cases. In one the Iris is in the scar, and in another the Iris base was and remains adherent. In one the operation was followed by plastic, and in another by suppurative Iritis.

I have tried to confine myself to facts, and have ventured to express no opinion as to the effect of this dilatation of the arteries, and their wall thickness on the pressure within them, or on the escape of fluid through their walls. It will perhaps be possible to do this more effectively when the size of the aperture through which the Anterior Ciliaries enter the globe, and the distance to which this condition extends backwards along the trunks of the various vessels are determined.

A series of experimental researches, analogous to those recently carried out by Max Knies on healthy animals, would be of immense value in determining the mode in which the condition I have described finds expression in results.

Much remains to be said as to the influence of the Nervous System on arterial calibre and on the transudation of fluid from the vessels, more especially, perhaps, in relation to the sympathetic.

On these points I shall await with interest the observations of those distinguished physiologists who are also pathologists and oculists.

I have to express my great obligations to Dr. O'Brien, of the Indian Medical Service, for his valuable aid in the examination of the last 20 cases, and in preparing the analysis of the mass of observations upon which this paper is founded.

BILATERAL DEVIATIONS OF THE EYES.

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IT would be rash at the present time to make a positive statement as to the exact number of ways in which ocular movements are co-ordinated in the brain, but it may safely be asserted that the *chief* co-ordinations are of four kinds, viz.:—

1. Movement of both eyes to the right.
2. Movement of both eyes to the left.
3. Movement of both eyes downwards and inwards, narrowing of the pupils, and contraction of the ciliary muscles, producing increased convergence and accommodation.
4. Movement of both eyes upwards and outwards, producing diminished convergence, and accompanied by, though not actively producing, widening of the pupils, and relaxation of the accommodation.

Clinical observations have proved that these several forms of compound movement are produced by the action of distinct brain centres, and that disease may paralyse one or other of the four forms described, and leave the others intact.

In Vol. VIII of these reports I have recorded a case in which, with paralysis of the movement of both eyes to one side, the movement of convergence and accommodation remained perfect. (Case I.)

In Vol. IX I have recorded a case in which, with paralysis of the movement of both eyes upwards and outwards, the movement of both eyes to one side remained perfect. (Case IV.)

Allusions to these cases have been made recently by

Dr. Hughlings Jackson* and Dr. Ferrier†, which have confirmed my opinion as to their nature.

I am now able to complete the group by the record of a case which is an almost perfect counterpart to the second abovementioned (Case IV), a case in which the highly compound movement of both eyes downwards, with convergence and accommodation, was lost, while the other forms of movement were intact.

Wm. Y., æt. about 60, a very large heavy man, a publican by trade, consulted me in December, 1876, concerning his eyes. With the help of his wife he gave the following history. He had received a severe blow on the back of the head nearly a year ago. No bad consequences were noticed during the next few weeks. One night, without known cause, he became suddenly giddy, and "his sight was dim;" that night he snored very heavily, and next morning the right eyelid was down, and could not be raised by the natural effort. It was noticed on raising the lid that the eye squinted outwards, and that the pupil was very large. There was no pain or vomiting, and there was no loss of power in the limbs. The power of raising the lid and of moving the eye returned very gradually. The patient had always lived freely, and was probably of intemperate habits. He had had several attacks of gout.

At the time of my examination his eyes presented the following conditions:—

Right, emmetropia; $V. = \frac{1}{3}\frac{2}{0}$; accommodation absolutely wanting, — with lens, + 10 far point, at 10'', and near point at 10''.

Left, emmetropia; $V. = \frac{1}{4}\frac{2}{0}$; accommodation absolutely wanting, — with lens, + 10 far point at 10'', and near point at 10''.

Both pupils dilated, the left rather larger than the right; neither pupil contracted in the least under strong illumination; neither pupil contracted with any movement of the eyes.

The disc healthy, or nearly so; there was a large "physiological cup" in each, perhaps partly atrophic. The visual axes were

* An Address on Ophthalmology in its Relation to General Medicine. *Vide* Brit. Med. Journal, June 2, 1877.

† Gulstonian Lectures on the Localisation of Cerebral Disease. *Vide* Brit. Med. Journal, April 6, 1878.

considerably divergent. The left eye usually "fixed," the right deviated outwards, and a little upwards. The amount of the divergence and upward deviation was measured by prisms. Prisms of 16° and 14° placed with their bases towards the nose, neutralised the divergence, and brought the double images of a distant object, the one vertically over the other; an additional prism of 7° , placed with its base downwards before the right eye, brought the double images together.

The movements of each eye were tested by vertical and horizontal movement of an object before the patient, the other eye being covered; they were similar in each eye, viz., each eye moved—

Outwards, steadily, and apparently quite to the normal extent.

Inwards, steadily, and apparently quite to the normal extent.

Upwards, probably to the normal extent, but more easily upwards and outwards than upwards and downwards.

Downwards, not at all. Neither eye had the power to pass the horizontal plane in a downward direction, to the smallest extent. In fact the lowest level to which either eye could be directed was probably somewhat above the horizontal plane, when the plane of the face was vertical.

The divergence of the visual axes persisted during all movements of the eyes. The power of diminishing the divergence which is usually to be observed in cases of divergent strabismus, when the patient "fixes" a near object, was entirely absent. When the test object was made to approach the patient's face, he continued to "fix" it with the left eye, but the *inward* movement thereby involved was accompanied by an *outward* movement of the right eye. The left eye being covered the object being again made to approach the face, the right eye fixed it without difficulty, and, as in the other case, the inward movement of the fixing eye was accompanied by an outward movement of its fellow.

On January 16th, 1877, that is about five weeks after his first visit, the patient, who lived at a distance from Birmingham, came again. I repeated the examination of his eyes as to every detail, and found the conditions to be precisely the same as they were before.

As the symptoms of the case were remarkable, and, in

my experience, unique, I desired to corroborate my observation by the evidence of another witness. My colleague, Dr. Carter, kindly went with me through every step of the examination, with the result already recorded.

In October, 1877, and again in February, 1878, I repeated the examination, on each occasion with precisely the same results as before.

At different times iodide with bromide of potassium, strychnia, with phosphoric acid, and Friederichshall bitter water, were prescribed, but as regards the ocular condition no change was effected thereby.

With the view of testing the nature of the paralysis of the iris and ciliary muscle, Calabar gelatine discs were applied to each eye at one of the vists.

Twenty minutes later both pupils were much diminished in size, but no change was discovered in the condition of the accommodation; with lens + 10, the far point and the near point were both at 10", as before.

After a prolonged use of the Calabar discs, extending over some weeks, the conditions were still the same.

I last saw the patient in February of the present year, when the state of the eyes continued unchanged. His chief complaint was of difficulty in guiding himself when walking, especially in stepping up or down stairs.

Referring again to the four co-ordinations of ocular movements enumerated at the commencement of the paper, it will be seen that the movements absent in the present case correspond with the group constituting the third form of co-ordination.

Convergent movement was lost. — Each eye had free lateral movements in both directions, but only that form of lateral movements in which the internal rectus of one eye is associated with the external rectus of the other. The divergence of the visual axes may with great probability be ascribed to the unopposed action of the brain centre, whose function it is to diminish convergence, just as in certain cases of hemiplegia, bilateral deviation of the eyes

to the one side is caused by unopposed action of the healthy brain centre, whose function it is to turn the eyes in that direction.

Downward movement was lost.—This is a form of paralysis which is certainly extremely rare. I have seen no other case in which free movement inwards co-existed with absolute loss of movement downwards. If we try to explain it by a lesion of the nerves which actuates the inferior rectus, we must suppose the lesion to be limited to that branch, or to those fibres, of the third nerve, which supply this muscle. Such a limitation could rarely occur even the case of one eye, but when we find that both eyes are thus affected we are driven back to a brain centre actuating both inferior recti as the only possible seat of the lesion.

Bearing in mind the conditions observed in other forms of bilateral ocular paralysis, we might expect to find, associated with loss of movement downwards, a persistent deviation of both the eyes upwards from unopposed action of the opposing centre. The right eye was always directed to a higher point than the left, but whether the lowest point to which the left could be directed was on the plane which is normally associated with a vertical position of the face, I could not determine. To ascertain this, it would be necessary to know the exact level at which the actions of the superior and inferior recti, with their respectively associated obliqui, are in equilibrium.

How is the upward deviation of the right eye as compared with the left to be explained? Without attempting, or wishing, to bind facts into accord with theory, I would suggest that this dissimilarity may have been due to the paralysis of the right third nerve, which, if we accept the patient's account of the onset of the attack, was one of the first symptoms.

That the paralysis of this nerve-trunk had disappeared is certain, for the eyelid was raised with ease, and the eye turned freely inwards; but the fact that the right inferior

rectus had suffered, so to speak, a double paralysis—a peripheral and a central—while the left had suffered the central only, is worth remembering in connection with the upward deviation of the right eye.

Perhaps the divergence of the visual axes should be attributed to the foregoing paralysis of the right third nerve, rather than, as suggested above, to the unopposed action of the centre for movements upwards and outwards. Perhaps both causes were concerned. But, seeing that the eye could turn freely inwards, and that no “lagging behind,”—that is no weakness in the internal rectus muscle—was discovered, it appears to me to be more reasonable to attribute the divergence to the central rather than to the peripheral cause.

The sphincters of the pupils were paralysed.—Under normal conditions the pupils contract in association with the bilateral movement of convergence. The simultaneous loss of these actions in the present case supports the view that their co-ordination depends on a structural combination in the brain. The inequality of the size of the pupils may possibly, like the upward deviation of the right eye, have been due to the paralysis of the right third nerve trunk. On this supposition, however, one would have expected to find the right pupil larger than the left, whereas the inequality was the reverse of this. It is worthy of remark that the pupils had lost, not only the action normally associated with convergence and accommodation, but also the reflex action induced by the stimulation of light. Is there a common brain centre for both these forms of action, closely related to the centre for movements of convergence, but capable of being thrown into independent reflex action, through a connection with the centres for visual perception?

Accommodation was lost.—Not much importance can be attached to the absence of accommodative power, for in a man of 60 years of age, whose habits of life would certainly tend to induce degenerative changes in advance of his

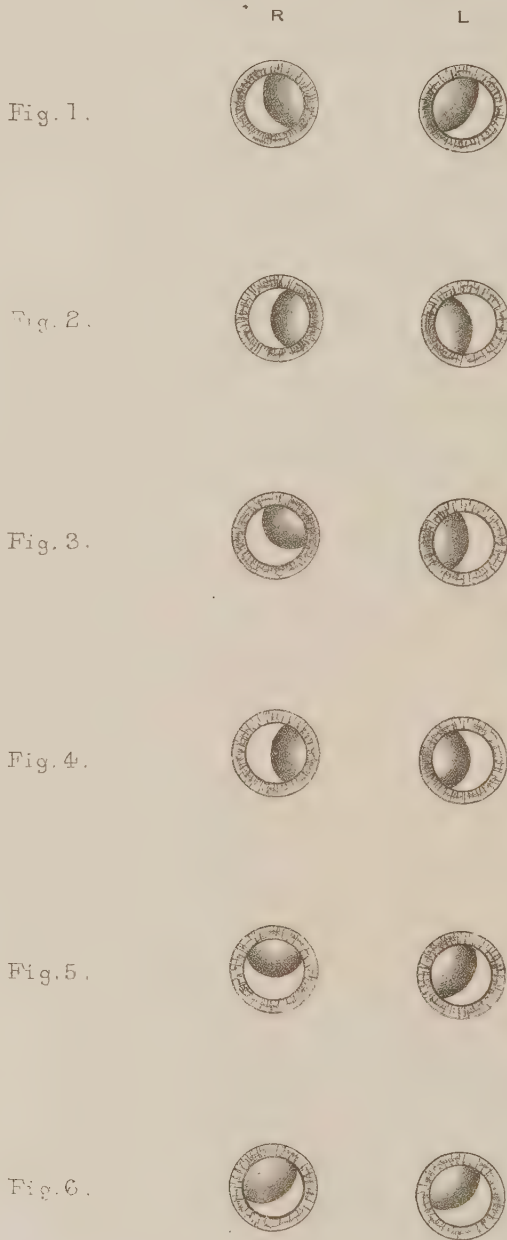
years, the range of accommodation would under any circumstances be very small. The fact that Calabar bean produced considerable contraction of the pupils but no change in the accommodation, tends to show that the ability of the lens to alter its shape was reduced to a minimum. The action of the gelatine discs is, however, too weak to give decisive evidence on this point, and at the time when the examination was made, I had not any experience of the far more powerful sulphate of eserine.

Having now recapitulated and discussed the forms of movement, which were absent in this case, I would point out in conclusion that the other forms of co-ordinated movement, viz., 1, 2, were intact.

Both eyes could move freely to the right.

Both eyes could move freely to the left.

Movement of both eyes upwards and outwards was represented by a considerable deviation outwards, *i.e.*, by divergence, and by a less certain though probable deviation upwards. In so far as it was not represented by a deviation upwards, it existed as a power of movement in that direction.



CONGENITAL DISPLACEMENT OF BOTH LENSES, OCCURRING
IN SEVERAL MEMBERS OF ONE FAMILY.

By A. STANFORD MORTON, M.B.,

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FOR permission to publish the notes and sketches, which I made of these interesting cases, I am indebted to the kindness of Mr. Wordsworth, in whose clinique at Moorfields they presented themselves in November, 1877.

Congenital displacement of the crystalline lens is, *per se*, not an exceedingly rare occurrence, but the cases now under notice are of peculiar interest, as showing, to a remarkable degree, the transmissibility of this deformity which occurred *presumably* in 5 successive generations, comprising 10 individuals; but *certainly* in 3 successive generations comprising 7 individuals, of 6 of whom the accompanying drawings have been made.

The subjects of this defect are all well developed, and of rather above the average intelligence of hospital patients. They all complain of being "near-sighted," and some of them mention having "to set" their eyes when wishing to discern any particular object.

The 6 individuals who have been seen are Mrs. Harboot, æt. 59, her two eldest sons aged 37 and 35, two children of the eldest son and one child of the second son. The 7th person mentioned above is the third son of Mrs. H. . He is now in New Zealand, but there is no doubt of his having displaced lenses, as he, his mother, and two elder brothers, are the subjects of Mr. Dixon's notes on partial displacement of the lens occurring in a mother and her 3 sons. (R.L.O.H. Reports, vol. i, part 54.) The remaining 3 individuals are Mrs. H.'s father, uncle, and grandfather, each of whom, she states, had the same defect as herself; and there is every reason to believe in the accuracy of this statement, as the family recognise perfectly among themselves those

who have this congenital defect; for on ophthalmoscopic examination it was found present only in those who were stated to have it, and not in any of the others who were said to be free from it; and although among the latter there was one of Mrs. H.'s sons who had $\frac{1}{2}$ of hypermetropic astigmatism and another with $\frac{1}{4}$ of myopia with their accompanying visual imperfections, yet neither of these were for a moment supposed to have the same congenital defect as Mrs. H. and the others mentioned.

After dilating the pupils with atropine and throwing the light from the ophthalmoscope mirror into the eyes, the appearances observed were as shown in the sketches, by reference to which it will be seen that the most general direction of displacement is inwards, either directly, or with an inclination upwards, but in the R. eye of Fig. 5 it is directly upwards; while in the R. eye of Fig. 6 it is upwards and outwards, and in the L. eye of Fig. 2 it is inwards and very slightly downwards. In all of them, except Fig. 1, where the lenses were becoming cataractous, the optic disc with its vessels, by using the mirror alone, could be seen at the same time both through and beside the crystalline lens, in the former case the image being inverted and moving in an opposite direction to the observer's head; while in the latter case it was erect and moved in the same direction, so that the two images crossed each other as the observer's head was moved laterally, showing the myopic and hypermetropic refraction respectively. The details of the optic disc with its afferent and efferent vessels are not represented in these sketches, as the appearances are admirably delineated by Mr. Streatfeild in the R.L.O.H. Reports, vol. viii, part iii.

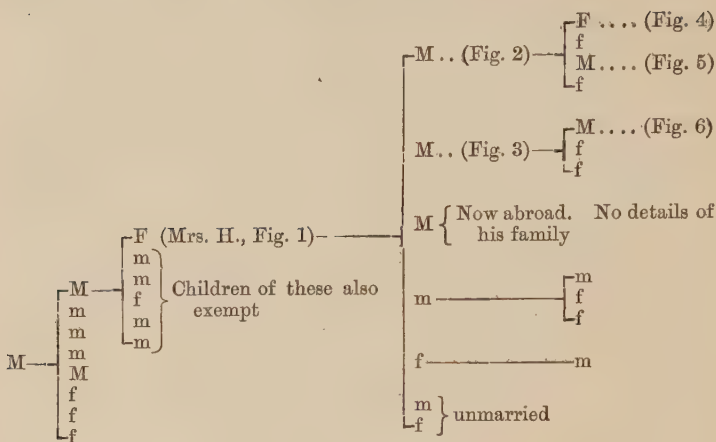
In all the cases the irides were tremulous, more especially in that part unsupported by the lens. In Figs. 1, 3, and 6, they were brown, and in the others grey or greyish-blue.

On using the oblique illumination, the lenses appeared of the normal size and shape, with a good round outline, and there was not perceived any of the "trilinear arrange-

ment of the segments" as described by Mr. Bowman in his very interesting report on a misplaced lens which he removed from a young man (R.L.O.H. Reports, vol. v, part i), but they presented a somewhat uniform milky appearance. In most of the eyes there could be distinctly traced very fine white striæ passing from the edge of the lens to behind the iris towards its ciliary attachment, running in a direction parallel to that in which the lens was displaced; they were narrow and pointed at the periphery of the lens, but spread out radially towards the iris, presenting the appearance of folds in a fine membrane, and were doubtless due to minute folds in the drawn-out suspensory ligaments of the lens.

It is instructive in all cases of transmission of deformity or disease to note the direction in which the descent occurs, whether it be chiefly through the eldest or youngest, or the males or females, of a family. In the present cases, as the following table clearly indicates, the *eldest*, whether male or female of each generation, has invariably been the subject of the hereditary defect; and further, unless the eldest happened to be a female, this latter sex has been exempt while several younger males have been attacked, so that out of 10 individuals only 2 were females.

The subjoined chart shows at a glance the 5 successive generations, commencing with Mrs. H.'s grandfather. The letters M and F stand for male and female respectively, and only those printed in capitals had the congenital displacement.



The last point of interest is the vision of these individuals which was taken in four cases, the remaining two being too young for definite information.

Mrs. H., æt. 59 (Fig. 1). $V. = \text{not } \frac{2}{200}$ and J. 1 at 8 inches. With glasses, $V. = \text{with } + 4, \frac{2}{70}$ or with $- 7, \frac{2}{50}$ and with $+ 30, J. 1$ at 12 inches. When under atropine, $V. = \text{not } \frac{2}{200}$ and J. 8 at 10 inches. With glasses, $+ 4\frac{1}{2}, \frac{2}{50}$ and $+ 2, J. 1$. Ordered $+ 30$.

George H., æt. 37 (Fig. 2). Uses chiefly his L. eye; for this when under atropine, $V. = \frac{2}{100}$, J. 1 at $1\frac{1}{2}$ inches. With glasses, $+ 14, \frac{2}{50}$, $+ 3, J. 1$ at 5 inches, or with $+ 8, J. 8$ at 14 inches; R. eye $V. = \text{not } \frac{2}{200}$, letters of J. 19. With glasses, $V. = \text{with } + 20, \frac{2}{70}$, with $+ 3, J. 12$ for a few seconds. Without atropine, $V. = \text{L. eye, } J. 2$ at 3 inches by nearly closing his eye, and holding the type well to the L. side. Ordered $+ 8$.

William H., æt. 35 (Fig. 3). Uses chiefly his R. eye. $V. = \text{R. and L., } J. 1$ at 2 inches by using one eye at a time, and holding the type well to corresponding side. With glasses, $V. = \text{with } + 8, \frac{2}{50}$ and J. 1 at 10 inches. R. and L., under atropine, R. eye $V. = \frac{2}{200}$, J. 1 at 2 inches. L. eye $V. = \text{not } \frac{2}{200}$, J. 1 at 2 inches. With glasses, each eye $V. = \text{with } + 3\frac{1}{2}, \frac{2}{50}$, or with $- 2, \frac{2}{100}$; and with $+ 3\frac{1}{2}, J. 1$ at 8 inches for R. and at $5\frac{1}{2}$ inches for L. Ordered $+ 8$.

Maude H., æt. 10 (Fig. 4). $V. = \frac{2}{200}$, J. 1 at $1\frac{1}{2}$ inches; with glasses, $V. = \text{with } + 12, \frac{2}{70}$, and J. 1 at 3 inches, or with $- 6, \frac{2}{200}$.

After atropine, V. = $\frac{20}{100}$, J. 1 at $1\frac{1}{2}$ inches; with glasses, V. = with + 10, $\frac{20}{100}$, with + 2, J. 1 at 4 inches. Ordered + 12.

On using the direct method of examination, the optic discs could be seen on looking at the side of the displaced crystalline lens, for which purpose, with the observer's accommodation relaxed, the strongest convex lens with which they were visible being + 5 for Mrs. H., + 10 for George, + 5 for William, and + 7 for Maude. A well-marked myopic crescent was present at the outer side of the optic discs of George and Maude. In George, William, Maude, only one eye was used at a time for either near or distant vision. In the former case the type was held close to the nose and to the side corresponding to the eye being employed, giving exactly the appearance of a very myopic person reading with one eye; the vision was probably obtained through near the centre of the crystalline lens in each case, but when convex glasses were employed, the type was held further off, and was probably seen through the periphery of the crystalline lens. For distant vision when the patient was placed at 20 feet from the types, with one eye covered, the other eye was always turned very much outwards, when a strong concave lens was placed in front of it, and *vice versa* a good deal inwards when a strong convex was substituted for the concave lens, as if in the former case vision was obtained through or near the centre of the patient's crystalline lens, and in the latter case either through the periphery or altogether beside it.

With even such defects as misplaced lenses, the individuals seem not to be much inconvenienced, for Mrs. H. with + 30 reads J. 1 and sews with ease; George H. does not require glasses for his work, as stoker, but being fond of music can see it well with his + 8; while William H. is a tool setter, an occupation requiring good sight, but with his + 8 he can do his work well and read J. 1 at 10 inches.

CATALOGUE OF THE DIAGRAMS PRESENTED TO MOOR-
FIELDS HOSPITAL BY MR. HULKE, F.R.S.

I.

1. Vertical section of eyelid.
2. " " of skin of outer surface of lid.
3. Vertical section showing the capillaries.
4. Horizontal section through eyelid.
5. Conjunctival surface of eyelid, showing Meibomian glands.
6. Capillary network around a Meibomian follicle.
7. Horizontal section through lid, showing origin of Horner's muscle.
8. Horner's muscle as seen when the eyelid is everted and the conjunctiva removed.
9. Circular bundles of Horner's muscle surrounding the lachrymal punctum.
10. Lymphatics of the ocular conjunctiva.

II.

1. Retina of fishes, showing the cones. (i) perch; (ii) pike.
2. Retina of frog, cones, &c.
3. " frog, inner granules, &c.
4. Retina of salamander.
5. " " "
6. " chameleon, fovea centralis.
7. Retina of chameleon near edge of fovea centralis.
8. Fovea of chameleon.
9. Chameleon, nerve fibre plexus.
- 9a. " ganglion cell and nerve fibres.
10. Rods and cones of blindworm, &c.
11. Retina of iguana.
12. " gecko.
13. " " "
14. " snake.

15. Retina of turtle.

15a. " *Emys Europæa*.

16. " black crested sea eagle.

17. Rods and cones of vociferous sea eagle and of skylark.

18. Human retina at equator.

19. Section through human yellow spot.

20. Fovea centralis (human).

21. Cones (human).

22. Retinal capillaries.

23. Artery and capillaries of retina of monkey.

24. Fovea centralis (human).

25. Pectens and vertical sections of optic nerve, entrance of (i) chameleon; (2) iguana; (iii) gecko; (iv) alligator; (5) boa; (vi) viper.

26. Vertical sections of optic nerve, entrance of (i) horse; (ii) Formosan deer; (iii) red deer.

27. Cross section of optic nerve of Formosan deer.

III.

1. Cornea, section through it.
2. Network of cells in superficial layers of cornea of human infant.
3. Fœtal cornea (human), 5th month (in duplicate).
4. Vertical section showing anterior corneal epithelium.
5. Vertical section showing posterior corneal epithelium and adjacent cornea.
- 5a. Vertical section showing posterior corneal epithelium and adjacent cornea.
6. Corneal nerves.
- 6a. Corneal nerves of ox.
- 6b. " (vertical section).
7. Section through sclero-corneal junction (duplicate).

8. Vertical section of cornea, showing anterior elastic lamina and epithelium.
9. *Ligamentum Iridis Pectinatum*, its outer surface.

V.

- A¹. Human eye, 4th week.
- A². Rudiment of embryo, rabbit. (β) human embryo, 7th week.
- A³. Eye of chick.
1. Capsular epithelium.
2. " " from equator, development of fibres of lens.
3. Lens fibres and capsular epithelium.
4. Lens fibres of *Chelone mydas*.
5. Lens fibres.
- 5a. Bundle of lens fibres and capsular epithelium.
6. *Podargus Cuvieri*, insertion of fibres on lens, &c. *Falco*, ditto.
7. Common snakes, lens fibres.
8. Lens fibres (human).
9. " of porpoise and wild boar.
10. Human lens in fœtus, child, adult.
11. Iguana, section through axis of lens.
12. Accommodation; attachment of *Lig. Suspensorium Lentis*.
13. Origin of suspensory ligament of lens.
14. Intracapsular epithelium, cells of matrix undergoing transformation into cuticular fibres.
15. Wrinkled capsule of lens seen on flat.

VI. Coloured Diagrams.

1. Opaque nerve fibres at optic nerve entrance.
2. Morbid appearances in retina associated with kidney disease.
3. Morbid retina in kidney disease.
4. Hæmorrhagic neuro-retinitis.
5. Neuro-retinitis.
6. Sclero-choroiditis posterior (posterior staphyloma); 4 figures.

7. Coloboma of iris, and of choroid and optic nerve sheath.
8. Choroiditis exsudativa.
9. Detachment of retina.
10. Neuritis optica.
11. α -Retinitis pigmentosa; β -choroiditis with pigment surrounding a vein.

VII.

1. Melanotic sarcoma of choroid.
2. " "
3. Melanotic cancer of choroid.
4. Spindle cell sarcoma of choroid, with coarcted retina.
5. Spindle cell sarcoma of choroid.
6. Retinal glioma.
7. Spindle cell melanotic and medullary sarcoma.
8. Melanotic sarcoma, beginning in an atrophied eyeball.
9. Cancerous infection of the sheath of the optic nerve.
10. Medullary cancer of choroid perforating a coarcted retina.
11. Retinal glioma.
12. " "
13. " " α . Centre of retinal tumour. β . Right optic nerve near commissure. γ . Cross section of optic nerve in front of commissure.
14. Cyst of iris.
15. " epithelium lining it.

VIII.

1. Partial staphyloma of cornea, with coarctation of retina and hæmorrhage at the outer surface of choroid. (β .) Hæmorrhage from choroidal veins, detaching choroid from sclerotic, and extruding vitreous and retina through the incision for the extraction of cataract.
2. Ectasia of sclerotic and choroid, coarctation of retina, with retinal hæmorrhages. (β .) Laminated coagulum between retina and choroid.
3. Large blood-clot in a detached retina.

IX.

1. Normal pigment epithelium of retina.
2. Colloid globes on vitreous lamina of choroid.
3. Colloid thickening of vitreous lamina seen in profile.
4. Group of retinal epithelium cells overlying a vessel, and surrounded by wasted cells.
5. Ossifying fibrous mass between choroid and strongly contracted retina.
6. Ossifications at inner surface of choroid.
7. Choroidal stroma filled with exudation corpuscles from a case of sympathetic choroiditis.
8. Congested chorio-capillaris.

X.

1. Optic papilla swollen by venous congestion (Stauung's papilla), inflammatory swelling.
2. Excavated optic nerve entrances of glaucomatous eyes.
3. Inflamed optic nerve, proliferation of neuroglial corpuscles.
4. Cross section of optic nerve. Neuritis, fibrillated exudation in the loose tissue between inner and outer nerve sheaths.
5. Calcified retinal capillaries.
6. Dilated retinal capillaries.
7. Sacculated retinal capillaries.
8. Colloid globes on Membrana Limitans Interna Retinae.
9. Retina of a person who died with granular contracted kidney.
10. Retina with contracted granular kidney.
11. Vertical section through healthy optic nerve (human).
- 11a. Vertical section through healthy optic nerve (human).
- 11β. Vertical section through healthy optic nerve (human).

12. Cross section through optic nerve $\frac{1}{4}$ inch behind the eyeball.
- 12a. Shallow glaucomatous excavation of optic nerve entrance.
- 12β. Optic nerve entrance, showing (i) a very deep physiological pit; (ii) a pressure pit.
- 12γ. Transverse section of optic nerve.

XI.

1. Cicatrix of corneal ulcer (in duplicate).
2. Corneal wound with prolapse of iris (duplicate).
3. Proliferating corneal corpuscles in inflammation (duplicate).
4. Conical cornea (duplicate), sections of cones (α) at summit; (β) at base.
5. Colloid globes on the posterior elastic lamina of the cornea.
6. Cancer of cornea.
7. Epithelium from equatorial region of lens capsule of a child.
8. Fibrous web on inner surface of capsule derived from epithelium.
9. Cells of hyaloid (α) normal; (β) from opaque vitreous in anterior staphyloma.
10. Vitreous, fibrillation of its corpuscles.
11. Wrinkled capsule.
12. " " fibrous tissue on its inner surface from an old shrunken cataract.
13. Central pyramidal cataract (β) nucleated fibrous tissue on the inner surface of the capsule evolved from epithelium.

XII.

15. Diagrams illustrative of various refractive conditions.

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